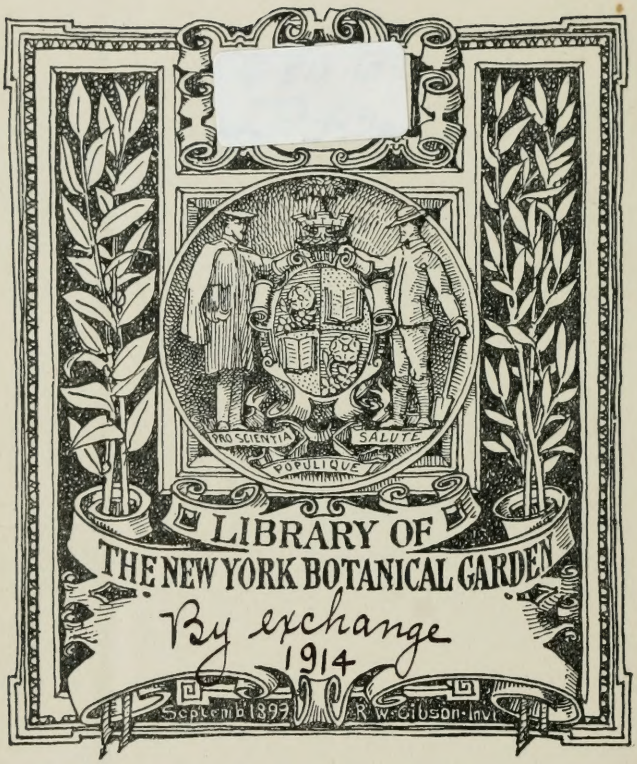
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SIXTEENTH ANNUAL REPORT

OF THE

PENNSYLVANIA

Department of Agriculture

1910

HARRISBURG:
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PENNSYLVANIA DEPARTMENT OF AGRICULTURE

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SIXTEENTH ANNUAL REPORT

OF THE

SECRETARY OF AGRICULTURE

DEPARTMENT OF AGRICULTURE,
Harrisburg, Pa., *January 1, 1911.*

To Hon. Edwin S. Stuart, Governor of Pennsylvania:

Sir: I have the honor to submit herewith the report of the operations of the Department of Agriculture for the year 1910, together with an estimate of the products of the farms of the State for the year, a partial preliminary report of agricultural statistics obtained from the Thirteenth Census of the State, some results achieved in the way of agricultural progress through the agency of this Department and some suggestions for future work and development.

CLIMATIC AND CONSEQUENT CROP CONDITIONS FOR THE YEAR

The rainfall for January averaged 4.97 inches, or about 1.50 of an inch above normal, which caused considerable flooding of the rivers of the State.

For February the rainfall amounted to 3.20 inches, about 0.58 of an inch below normal.

The month of March was remarkable for the total absence of weather conditions such as are characteristic of this season of the year. The rainfall averaged a little over half an inch for the State and was 3.16 below normal; the temperature averaged 8 degrees above normal.

With these weather conditions, farming operations began early, oats was sown, spring plowing for corn began and all growing crops were started fully two and more weeks before the usual time, and the buds of fruit trees were abnormally advanced.

The month of April was abnormal in both excessive temperature and precipitation and was noted for the absence of those periods of cold weather usually experienced at this season.

The average rainfall for the month was 5.7 inches, about 2 inches above normal. 8.50 inches of rain fell in Hamburg, Berks county, which is 4.85 inches above normal. This excessive precipitation retarded agricultural operations during this month and in some instances destroyed fruit buds.

The average precipitation for the month of May was 3.30 inches, which is considerable below normal; but the cool and cloudy weather with frequent showers and frosts during the first half of the month conserved the soil moisture sufficiently for all crops to make normal growth.

The average rainfall for the State during the month of June was 4.9 inches, which is approximately an inch above normal. Nearly all this precipitation occurred previous to the 19th. Previous to the 18th of the month decidely cool weather prevailed with frosts in exposed places doing considerable damage and retarding agricultural operations. This cool weather was especially prevalent in the vicinity of Philadelphia where the average temperature for the first twelve days of the month was lower than for any corresponding period for forty years.

The drought for July 1910 was so prevalent throughout the State, that with one single exception, that of State College, there was a deficiency of rainfall, varying from .038 of an inch in Berks county to 3.75 inches at Selinsgrove, Snyder county.

There were no general rains during the month of June, after the 19th, and local showers were usually quite limited in extent and duration. This deficiency of rainfall and the intense heat that prevailed, caused serious damage to garden crops, corn and pasture, and a shortage in the water supply for household purposes and farm animals. The wide-spread deficiency in rainfall continued during the entire month of August, and had it not been for the cooler weather prevailing during the month, conditions would have been still more serious. Deficiency of rainfall, with two exceptions, viz: at Philadelphia and West Chester, varied from 0.03 of an inch to 2.57 inches for the State.

Deficiencies in rainfall occurred during September, October, November and Deecmber, aggregating for the year in parts of Montgomery county 11.72 inches, in York county 8.54 inches, in Adams, 5.77 inches, in Franklin 5 inches, in Bedford 8.70 inches, in Somerset 8.56 inches, in Fayette 7.42 inches, in Greene 5.14 inches, in Washington 10.25 inches, in Indiana 5.99 inches, in Clinton 5.88 inches, in Cameron 5.33 inches, in Carbon 5.18 inches and in Pike 7.99 inches. Only four counties of the State report an excess of rainfall, Lawrence 2.20 inches, Luzerne 1.09 inches, Centre 0.20 and Bucks 0.18 inch. There was a deficiency of approximately four inches of rainfall over the entire State for the year, and as one inch of rainfall amounts to a little over 112 tons of water per acre, each acre of the State received about 448 tons of water less than usual with which to produce the agricultural crops of the year. It is evident that the eastern farmer, if present methods are to be pursued, needs to study eastern dry farming.

STAPLE FARM CROPS FOR 1910

The estimate of the staple farm crops given here include, Corn, Wheat, Oats, Rye, Buckwheat, Barley, Hay, Potatoes and Tobacco, and amounts to $172,362,500.

CORN

The corn crop, with more than ordinary dry weather in many of the corn growing sections of the State during the months of July and August shows, that farmers are beginning to learn some of the lessons available for supplying, through cultivation, what the regular summer showers in former years supplied.

The average yield per acre for 1910 is 41 bushels, with an acreage of 1,586,000, making a total yield of 65,026,000 bushels, worth December 1, $38,365,000. This is an increase of 16,226,000 bushels, or nine bushels per acre, over that of 1909; and is the highest yield obtained in the State since accurate statistics have been kept.

As stated in my report of 1909, movements have been started in many sections of the State by Farmers' Organizations, Corn Growers' Associations, Boys' Corn Clubs, Grangers' Fair Associations, Agricultural Societies, etc., for improving and increasing the yield of corn. These organizations have maintained their interest and are still actively at work. The State Livestock Breeders' Association again held its annual corn show in connection with the meeting of the State Board of Agriculture, at Harrisburg, January 24-27. Ten prizes were awarded for the best exhibits of ten ears of Flint, Yellow Dent, White Dent, White Cap Dent, Ninety Day types and mixed varieties of corn, and for Southeastern Pennsylvania varieties: a grand champion prize for the best ten ears in the show, and a sweepstake prize for the best ear of corn on exhibition were given. With climatic conditions, little, if any more favorable than the previous year, it is evident that these competitive exhibits, together with the work of this Department through its Division of Farmers' Institutes, the Experimental Station and the organizations above referred to, have aroused an interest in the development of corn growing which has been a great factor in making this increase of 16,226,000 bushels, worth to the Pennsylvania farmers more than $8,000,000, far more than has been appropriated for Agricultural Institutions in the entire history of the State.

WHEAT

The acreage of wheat in this State is three times as large as that of New York; larger than that of Ohio; nearly as large as that of Illinois; twice as large as that of Kentucky and Tennessee and larger than that of the great wheat-raising state of Washington.

The value of the wheat of this State is three times that of New York, is $2,000,000 greater than that of Ohio; three times greater than that of Kentucky and Tenessee, and within $5,000,000 as valuable as that of the State of Washington.

The average yield per acre for 1910 was 17.8 bushels with an acreage of 1,556,000, making a yield of 27,697,000 bushels, worth December 1, $25,481,000, or $3,148,000 less than the crop of 1909, which was 1,432,000 bushels less in yield. I know of no satisfactory explanation for this, when the yield in the United States was 1,000,000 less than in 1909.

OATS

The weather during the middle and latter part of March was favorable for sowing oats, and a large number of farmers sowed at this time, which, to some extent, accounts for the increase in yield. The yield increased from a little over 25 bushels per acre in 1909 to 35.2 bushels in 1910, which, with the same acreage as 1909, made a total of 35,130,000 bushels as against 25,948,000 bushels in 1909, worth over $2,000,000 more than the crop of 1909; whereas, the price of oats in 1909 was 50 cents a bushel while in 1910 it was worth but 41 cents.

This Department, through the agency of the Farmers' Institutes, has been trying to stimulate the raising of oats, particularly in the northern counties of the State, for the reason that, with climatic conditions especially well adapted to the growing of oats, it would take the place of corn as a grain ration for animals.

RYE

Pennsylvania raises a larger acreage of rye, a larger average yield per acre with a greater value per acre than any state in the Union. As suggested in my report for 1909, there are many soils especially adapted to growing rye, and when farmers are behind with their work and the season for sowing other cereals has passed, rye can be sowed with assurance of receiving a crop, and for these and other reasons a larger acreage should be grown. 380,000 acres were sowed with rye in 1910, yielding at the rate of 17 bushels per acre, or a total of 6,460,000 bushels, worth December 1, $4,716,000. The yield per acre in 1909 was 15.3 bushels and the money value of the crop was $4,406,000, or $310,000 less than in 1910.

BUCKWHEAT

Pennsylvania, with one exception (New York), raises a larger acreage of buckwheat than any other state in the Union. The short season required for growing this crop and the large yields that can be raised in poor soils, and its value as feed for all animals as well as for man, should induce raising it, when and wherever possible. 290,000 acres were sowed with buckwheat in 1910, yielding, 5,655,000 bushels, or at the rate of 19.5 bushels per acre, worth December 1, $3,506,000.

BARLEY

Of the 7,257,000 acres sown with barley in the United States, Pennsylvania had only 9,000 acres, yielding 238,000 bushels, at the rate of 26.5 bushels to the acre, worth December 1, $150,000, or at the rate of 63 cents per bushel. Barley is not so much a cool weather crop as is oats. It can be grown in a shorter season, will endure hot weather better, and therefore is a better crop than oats for the Southeastern section of the State where it seems to me it should, to a large extent, take the place of oats.

HAY

There was an increase in the yield of hay for 1910 over 1909 of 691,000 tons, making the tonnage approximately what it had been for the previous nine years. There was an increase of 94,000 acres in the acreage, which is as it should be because it is needed. 3,212,000 acres were sowed with grass in 1910, capable of yielding under present conditions a crop of at least 4,818,000 tons, at the rate of one and a half tons per acre, worth $72,270,000, making it the most valuable farm crop of the State.

POTATOES

In 1909 there were only six states in the Union that had a lower yield per acre of potatoes than Pennsylvania, and among these were North Carolina, South Carolina and Georgia. This is not as it should

be, because Pennsylvania has a large number of consumers of farm products, especially potatoes, in proportion to the number of persons engaged in farm-crop production, than any state in the Union; and she should supply a large quantity of these important vegetables for the consumer, especially when under the shadow of Altoona, Johnstown and Pittsburg as much as 350 bushels per acre have been raised. 320,000 acres were planted with potatoes in the State in 1910, yielding 28,160,000 bushels, an average of 88 bushels per acre, worth $14,643,000.

TOBACCO

There are but five states in the Union that raise a larger acreage of tobacco than Pennsylvania. In yield and value per acre, Pennsylvania is first among the five, with an average yield of 1,500 pounds per acre. There was an increase of over 500 pounds in yield per acre in 1910 over 1909, with an average increase of one-half a cent a pound in price. 33,680 acres were planted with tobacco in 1910 yielding 49,500,000 pounds, worth December 1, $4,603,500.

The foregoing estimates of the values of farm products do not include dairy cows, valued January 1, 1910, at $44,460,000; nor other cattle valued at $17,606,000; nor the horses and mules valued at $81,708,000; nor swine valued at $8,844,000; nor the sheep and wool valued at $5,338,000; neither does it include the fruit crops or vegetables which, at a low estimate, would be worth an additional $50,000,000.

CENSUS STATISTICS

FIRST PRELIMINARY STATEMENT OF FARM DATA BY THE CENSUS BUREAU FOR PENNSYLVANIA, 1910

The statement shows in detail that the number of farms reported in 1910 was 218,394, as compared with 224,248 in 1900, a decrease of 5,854, or 2.6 per cent.

The total value of farm land and buildings was given in 1910 as $1,035,300,000 as against $898,273,000 in 1900, an increase of $137,027,000, or 15.2 per cent.

The total value of all farm land alone was reported in 1910 as $627,185,000 as compared with $575,393,000 in 1900, a gain of $51,792,000, or 9 per cent.

The total value of farm buildings alone was given in 1910 as $408,115,000 as against $322,880,000 in 1900, an increase of $85,235,000, or 26 per cent.

In 1910 the value of the farm land alone constituted 61 per cent. of the total value of land and buildings, as compared with 64 per cent. in 1900.

The reported value of farm implements and machinery was $70,547,000 in 1910 as against $50,917,000 in 1900, a gain of $19,630,000, or 38.5 per cent.

The total acreage reported in 1910 was 18,556,000 acres, as compared with 19,371,000 in 1900, a decrease of 815,000 acres, or 4.2 per cent.

The improved acreage was returned in 1910 as amounting to 12,660,000 acres, as against 13,209,000 in 1900, a decrease of 549,000 acres, or 4.1 per cent.

The improved acreage formed 68 per cent. of the total acreage in both 1910 and 1900.

The average acres per farm reported in 1910 was 85, as against 86 in 1900, a decrease of 1 acre, or 1.16 per cent.

AVERAGE VALUE PER ACRE

The average value per acre of farm land and buildings in 1910 is stated as $55.79, as against $46.37 in 1900, a rise of $9.42, or 20.3 per cent.

The average value per acre of farm land alone in 1910 was reported as $33.80, while in 1900 it was $29.70, the amount of gain being $4.10, or 13.8 per cent.

The total number of farms operated in 1910 by owners, part owners, and owners and tenants, comprising the "all owners" class, was 163,587, as compared with 162,279 in 1900, an increase of 1,308.

The total number of farms conducted in 1910 by cash tenants, share tenants and cash and share tenants, comprising the "all tenants" class, was 50,951, as against 58,266 in 1900, a decrease of 7,315.

The total number of farms operated by managers in 1910 was 3,856, as compared with 3,703 in 1900, an increase of 153.

The total number of farms operated by the "all owners" class constituted 75 per cent. of the whole number of farms in 1910, and 72 per cent. in 1900; those operated by the "all tenants" class, 23 per cent. in 1910, and 26 per cent. in 1900; and those conducted by managers, 2 per cent. in both 1910 and 1900.

Of the total number, 163,587, of farms operated in 1910 by the "all owners" class, there were 112,995, or 69 per cent., owned free of incumbrances, and 50,592, or 31 per cent. mortgaged.

The Census Bureau has no information respecting the number of mortgaged farms leased to tenants, nor figures for 1900 available for comparison with the 1910 data as to the incumbrances.

DISTRIBUTION ACCORDING TO ACREAGE GROUPS

The statement relative to farms distributed according to certain acreage groups shows that those of 19 acres and under numbered 37,993 in 1910 and 35,038 in 1900, a gain of 2,955; of 20 to 49 acres, 39,615 in 1910 and 41,575 in 1900, a decrease of 1,960; of 50 to 99 acres, 65,626 in 1910 and 69,670 in 1900, a decrease of 4,044; of 100 to 174 acres, 55,471 in 1910 and 57,800 in 1900, a decrease of 2,329; of 175 to 499 acres, 18,898 in 1910 and 19,239 in 1900, a falling off of 341; of 500 to 999 acres, 627 in 1910 and 688 in 1900, a decrease of 61; and 1,000 acres and over, 164 in 1910 and 238 in 1900, a decrease of 74.

These statistics show that the tendency is toward smaller farms and, as a consequence, more intensive farming.

The expenditure for labor in 1910 reached the sum of $25,079,000, as compared with $16,648,000 in 1900, an increase of $8,431,000, or 50.6 per cent.

The expenditure for fertilizers amounted in 1910 to $6,756,000, while in 1900 it was $4,686,000, an increase of $2,070,000, or 44 per cent.

PENNSYLVANIA AN IMPORTING STATE

Notwithstanding the enormous values of our farm crops and the slight increase in production per acre for the year 1910, Pennsylvania does not produce enough to feed her citizens, and instead of being an exporting State she imports millions of dollars worth of farm products, and an importing State of farm products like an importing nation should and must have, for her own best interests, an intensive agriculture.

In my report for 1909, under the head of Feeding Requirements, an estimate was made of the feed required for farm animals and a showing of about how much is imported into the State over the amount raised. Under the head of Dairying and Raising Crops for the Dairy, a statement was made of the crops that should and could be raised to furnish food for dairy cows. Under the head of Crop Rations, rotation was suggested of crops for the various sections of the State to furnish the roughage and grain for the dairy cows in use, in connection with the silo. An effort was also made to show how the fertility of the soil is destroyed and removed and how it may be prevented. Reference is made to this matter again, for the reason that the maintenance of the fertility of the soil is fundamental, because it stands for a permanent agriculture, and any nation that has a permanent agriculture will have a permanent existence. A Beatitude something like the following can be applied to such a nation: "Blessed is the nation that has a permanent agriculture, for she shall endure."

A permanent agriculture means constructive farming or the production and the keeping on the farm of so much fertility as is used by the crops raised. The fact that fertility is purchased and brought to the farm instead of being produced there, is proven by the increase of the fertilizer bill of the farmers of the State of $2,070,000 since 1900, or an increase of 44 per cent.

CENTRALIZATION OF CONSUMERS OF FARM PRODUCTS

The possibility of getting the food supplies from every climate of the country through the agency of our transportation companies, has led to the centralization of our factories where labor is plentiful and cheap and at or near where the raw materials used by the manufacturer are located or to where they can easily be transported. Pennsylvania, on account of her enormous supplies of coal, oil, gas, limestone, iron ore, and until recent years, wood, and her early prestige as an agricultural state and her splendid location for shipment to domestic and foreign markets, has become a manufacturing center and therefore a center of enormous consumption of agricultural products. These natural advantages have given to Pennsylvania markets that are unsurpassed, and the ambition of Pennsylvania farmers should be to supply these markets, as nearly as possible, with everything they need, and thereby reduce importation to a minimum.

A SYSTEM OF MERCHANDISING

A system of merchandising is often a necessary adjunct to transportation, but it should be only an adjunct and not cost more than the production, manufacture and transportation of the commodities it handles without adding to their value.

Secretary Wilson, of the National Department of Agriculture, in his report for 1910, says: "It is established by the investigations of this Department, made last June, that the milk consumers of seventy-eight cities paid for milk, an increase of 100.8 per cent. above the price received by the Dairyman. The lowest increase among the Geographic Divisions was 75.5 per cent. in the South Atlantic States and the highest was 111.9 per cent. in the Western States." For butter, the consumer pays the dealer about 15 per cent. above creamery prices which is not more than it should be, but when we compare creamery prices with the prices paid the farmer at his local markets, the consumer pays from 50 to 60 per cent. above the farmers' prices.

Taking other commodities, it is found that the middleman receives 260 per cent. above farmers' prices for onions sold by the peck, 400.4 per cent. for oranges bought by the dozen, 200 per cent. for watermelons sold singly, 90.5 per cent. for apples bought by the barrel, 80.6 per cent. for apples bought by the box, 75 per cent. for chickens sold by the head, 80.5 per cent. for potatoes by the bushel, 88.8 per cent. for poultry by the pound, 95.3 per cent. for strawberries by the box, 82.5 per cent. for sweet potatoes by the bushel, 66.7 per cent. for celery by the bunch, and 59.8 per cent. for turkeys by the pound. The import price of coffee for the fiscal year 1910 was eight cents a pound, including freights. The price of this coffee to the consumer was from 150 to 337.5 per cent. above its cost to the importers and middlemen.

COLD STORAGE

The impossibility to produce in the immediate vicinity of our enormous industrial plants, perishable food stuffs in sufficient quantity, and deliver them in fresh and edible condition to the consumer, has made it necessary to establish refrigerator car lines and cold storage plants, for the transporting of such commodities from all sections of the country and for keeping them in proper condition for food. These agencies for transporting and keeping agricultural products of all sections of the country in edible condition at all seasons, brings Florida and California fruits and vegetables to the door of the Pennsylvania mechanic, laborer and miner in December, January and February and has proved a great blessing. But while it has been a blessing it has opened the way for avaricious dealers in the necessaries of life, for their own enrichment, to buy these perishable products, when there is a surplus, either by an excess being shipped from a distance or when the local producer inadvertently overstocks the market, and hoard them until such time as the prices are satisfactory and then bring them into competition with the fresh products of the farmer. Refrigerator Car Lines and Cold Storage Companies should make it possible for the producer, when his own market is overstocked, to ship his products where there is a demand for them or to store them until his own, or a distant market

will consume them, without the necessity of paying exorbitant charges, and if these advantages to the public cannot be secured in any other way the whole matter should be regulated by legislation.

One of the agricultural industries of the State that has suffered a slow but sure process of weakening by the agencies referred to, is that of fattening cattle. The farmers, in many of the corn raising sections of the State, fatten steers with their corn to keep the fertility on the farm; one of the most desirable industries for the consumers of meat and for the farmer who works for a permanent agriculture, that can be practiced. These farmers go into the open markets in the fall of the year and buy what they call "feeders" and frequently are obliged to sell these steers the following spring, after having put them into the very best marketable condition, for the same price per cwt. they paid for them in the fall, or for the meagre advance of ten, twenty, thirty, forty or fifty cents per hundred pounds. To prove this statement, one need only consult the market journals, where it will be seen that feeders and stockers purchased in the fall sell for the same price in the spring as fat cattle. Talk to a farmer who has been following this business, about improving his farm or doing intensive farming, and he will be tempted to say things that should not go into a public report.

THE FARMER'S ATTITUDE

From these facts already given, it is plain that the farmer is not getting exorbitant prices for his products; that by the agencies that should be his servants he is sometimes made to be the competitor of the whole nation and even to compete with himself, and that while his products cost the ultimate consumer too much, this extra cost is added after delivery to the transportation companies and before reaching the ultimate consumer.

The farmer is not ignorant of these conditions. He says. "Why should I raise ten thousand heads of cabbage if by keeping down production I can get as much money for five thousand heads, or why should I keep a dairy of twenty cows if by keeping down production I can make as much out of a dairy of ten cows?"

If the producer could sell directly to the consumer, he would have the means of knowing how many cabbages and how many pounds of butter or how much of other products his patrons would consume, and all this effervescence of "over-production" and "not enough production" and "the high cost of living" would be to a great extent dispensed with.

People who complain of the high cost of living and who are disposed to lay the blame for the same upon the farmer, should give their attention to the possibility of eliminating the undue number of middlemen and their profits and, by arranging systems of co-operative buying, meet the farmer or producer upon some common ground or a basis of action that will prove profitable to both parties. In many instances, if general and local brokers, wholesalers and jobbers, together with the retail dealers, are all counted, it will be seen that many commodities must pay from three to five middlemen's profits before they get from the producer to the consumer. The farmers of the country are ready to join hands with the consumers in an arrangement for cutting out these unjust and unnecessary profits, as

soon as the latter are ready to take the steps so much needed to afford relief.

By what has been said about transportation and cold storage and middlemen, I do not mean to shield the unworthy farmer who produces milk and makes butter, to apreciate the flavor of which the consumer must have years of training, nor the man who sells sick animals to the butcher or kills them himself and sells the carcass to the consumer, nor the farmer who, when opportunity offers, will charge profits even to four hundred per cent., like the unscrupulous middleman. These all come under the same condemnation and are a discredit to the agricultural industry and injurious to our industrial system because they take from the ultimate consumer an unrighteous profit for an inferior article.

INTENSIVE FARMING

In the report of this Department for 1909 it was showed that in all probability $90,000,000 worth of feeding stuffs were imported into Pennsylvania, annually, the greater part of which could be raised in the State which would mean an income annually for each one of the 218,394 farmers of $412.00. The deficiences in farm products in this State consist largely of dairy products, meats, vegetables and feeding stuffs for dairy cows and meat-producing animals. If statistics can be relied on, it is evident that progress has been made rather slowly in intensive farming, with the exception of a steady increase in the production per acre of several of the staple crops, and even this has been slow and has not kept pace with the increase in population. The improved acreage of farm land in 1910 amounted to 12,666,000 acres, in 1900 to 13,209,000 acres, in 1890 to 13,210,000 acres and in 1880, to 13,423,000 acres, or the improved acreage in 1910 is 763,000 acres less than it was in 1880, thirty years ago. The population of the State in 1900 numbered 6,302,115; in 1890, 5,258,113; in 1880, 4,282,891, an increase of two million nineteen thousand two hundred and twenty-four or 32 per cent. between 1880 and 1900, whereas the improved acreage of agricultural land has decreased more than 6 per cent. All data for 1910 are not available. There is one gratification in this: That increased production per acre, the object for which this Department has been working, is beginning to show results.

To illustrate what could be done along other lines: I do not believe that there are many two acres in the dairy section of the State that would produce feeding stuff sufficient, if farmed intensively, to feed one dairy cow for a year. If we would take only one-third of the 12,660,000 acres of improved land for dairying we would have 4,220,000 acres which would keep 2,110,000 dairy cows, nearly twice the number we now have. This would leave 8,440,000 acres for raising other farm crops which, if farmed as intensively as the 4,220,000 acres for dairying would have to be, would produce equally good returns. But intensive farming is not confined to raising farm crops only, but applies to all farm operations and therefore includes the raising of the right kind of dairy cows and other animals. If the 2,110,000 cows that could be fed on one-third of the acreage of improved farming land in the State in 1910 would produce at the

rate of seven thousand pounds of milk annually we would have 14,770,000,000 pounds of milk every year or approximately 1,846,250,000 gallons. From this it is evident (and I have not stated impossible quantities, that this State with intensive farming and with the right kind of cows can produce sufficient milk and butter for all her citizens and at the same time be working for a permanent agriculture by constantly increasing the fertility of the soil.

EASTERN DRY FARMING

With four inches less rainfall in Pennsylvania in 1910 than normal and with some counties up to eight and a half and even as much as eleven and a quarter inches less, as has been the case in recent years in many localities, the question of eastern dry farming demands attention.

With this deficiency, if the rainfall would have been more equally distributed throughout the growing season, there would have been a sufficient precipitation for the growing of all farm crops in 1910. To illustrate: During the month of April, with the exception of the Ohio basin, there was an excess of rainfall throughout the State of approximately from one to five inches. If this excess of water could have been stored in some way as Nature does for the use of her crops, the deficiency in soil moisture that occurred from the latter part of June to well nigh the end of the year would not have been so injurious. Nature's methods for preventing the water from getting away by surface drainage (and approximately one-half of the water falling in rain on the cultivated and uncultivated soil gets away in this way) are first, the lowest species of plants growing on the rocks and stony soils, the lichens, mosses and algae. These have a wonderful capacity to take up or absorb moisture even from dew or the smallest summer showers, by opening and exposing their algaeic surfaces and again when the shower is over or when the morning sun appears closing and holding the absorbed moisture for their own and the growth of other plant life as well as for the decomposition of rocks. As plant life evolves from these lowly beginnings, sufficient foliage is produced to shade the soil which helps to conserve moisture, and when this plant life dies it falls on the soil and forms a thicker surface mulch by means of which nature takes up and retains a sufficient amount of water to sustain her plants during the dry times caused by the unequal distribution of rain, and also prevents the washing away of the soil she has made, thus doing dry and wet farming all the time. When the farmer cleared the land he removed nature's agencies for conserving soil moisture and therefore he must adopt methods for retaining this moisture that can be made practical.

The first thing a farmer does, after having removed the trees and vegetable growth, he plows the ground turning down the surface mulch already referred to. This breaking up of the soil will prepare it so that the rain will sink down into it and will not be carried away by surface drainage. As an implement for conserving moisture in all but sandy soils, the plow stands pre-eminent, because it can be made to break up the soil and make it fine to a greater depth than any other implement used in agriculture, and the deeper and finer a recently plowed soil is the more water it will hold. Frequent

plowing and thorough fining of clay soils is absolutely essential in intensive agriculture, all of which, for best results, must be done before sowing or planting any crop. After the soil is thoroughly fined and capillary action has been completely established between the plowed soil and the subsoil, and a crop, so planted or sown, such as corn, potatoes, some of the clovers or even wheat in the spring, that cultivation can be kept up; or fields prepared in this way and simply allowed to lay bare to be planted later, another method of conserving moisture, can be utilized by the farmer, that of making a surface mulch by means of harrowing, by which the capillary action that brings the moisture from the soil and subsoil is retarded on account of the enlargement of the spaces between the soil particles. This surface mulch should not be more than two or three inches deep and should be made with a harrow that will leave the soil comparatively level.

Soil moisture can also be conserved as Nature does by a covering of organic matter such as straw, or by the right use of stable manure. It has already been shown how soil moisture can be retained by cultivation in the case of crops that can be cultivated, but frequently it is necessary to conserve moisture on crops that cannot be cultivated, such as grass and here, if for no other reason, stable manure should be applied to conserve soil moisture. The best use of stable manure has been a subject of the greatest interest to the farmer, but he seldom considers it from the point of conserving moisture. It is necessary, however, only to refer to Nature's methods of conserving moisture by the use of a surface mulch of organic matter, to show the application. The absorbents such as straw, corn-fodder, hay or any other materials used for this purpose should be out into not more than inch lengths because they will better absorb the excreta of the animal, they can be more equally distributed on the soil, they will form a more perfect surface mulch to prevent the escape of soil moisture, they will decay more rapidly, will not be taken up by the hay-rake and the fertility contained in the excreta and the absorbents will be made available more rapidly. All these and more capacities can best be attained by applying the stable manure on a grass sod where it decomposes slowly and produces large quantities of roots and vegetable growth to be used as feed for animals, to make more manure or to be plowed down and the organic matter mixed with the soil. This logically brings up the subject of addition of organic matter to the soil, which is one of Nature's methods of soil building, while the other is rock disintegration. By the application of large quantities of stable manure and by plowing down green crops and heavy sods I have seen soils increased in depth and made capable of holding such large quantities of water obtained from the snows of the winter and the rains of the spring that they did not need the summer shower to produce crops. These methods with the exception of plowing, in the case of sandy soil, are applicable to all soils and can be made the means of conserving sufficient moisture, even in a season as dry as 1910, to produce better crops than if the season had been too wet. The selection and management of crop rotations for conserving moisture can best be done by the farmer acquainted with the soil.

Lime, gypsum and common salt assist in conserving soil moisture. Lime on a fine clay soil by granulating it and on a sandy soil by com-

bining its particles several inches beneath the surface. Reference has been made to the advantage of having corn stalks, straw and other litter used for bedding livestock cut into short lengths. Added to their increased absorbing capacity by being treated thus, is the fact that they will, when thus treated, require much less room for storage, and it is to be hoped that manufacturers of thrashing machines will in the near future equip their machines with an attachment for cutting the straw at the same time the thrashing is being done.

IRRIGATION

Irrigation has been discussed by some farmers in the State and projects for building large reservoirs in the deep valleys of the Delaware, Susquehanna and Ohio basins of the northern and central counties, for storing water to be used for irrigating agricultural lands lower down these valleys during dry seasons, have been under consideration. This looks well, but irrigation, as it is now practiced in the humid and semi-arid and arid regions, is an entirely different proposition and up to this time the humid irrigation project has not been working out in an extensive and practical way. To supply the enormous quantities of water needed to grow crops would require immense reservoirs and an outlay of money entirely beyond the means of the farmers and gardeners who would use it and, therefore, the State would have to build these reservoirs which might be feasible, but until the methods I have suggested for conserving moisture have been found insufficient the irrigation project should be allowed to slumber. Another thing to be considered is the fact that in the semi-arid and arid regions, where irrigation is extensively practiced, farmers do not have to take into consideration, when they are irrigating, the possibility of within four or five hours thereafter, having a rainfall of several inches which might mean serious injury to, or the entire destruction of the crop irrigated.

WORK DONE BY THE DEPARTMENT

BUREAU OF FARMERS' INSTITUTES

Farmers' Institutes were held in every county of the State during the year. The State was divided into five districts so that throughout the Institute season, beginning November 25, and ending March 9, there were five Institutes in progress nearly every day, making in all four hundred and thirty days of regular institutes held in the State. There were also seventeen special Institutes. Movable Schools of Agriculture were likewise held in eleven counties, continuing in session from four to six days, and speakers were furnished by the Bureau for a number of Harvest Home gatherings at which farm topics were discussed. The number present at these meetings aggregated nearly 200,000, which will give some idea of the immensity and importance of the work.

BUREAU OF ECONOMIC ZOOLOGY

The work of this Bureau was pursued during the year with the promptness and activity its character demands. Many accessions were made to the number of specimens sent to the Bureau by correspondents, with requests for information regarding the same. One hundred and eighty-eight nurseries, covering over three thousand acres of ground, were inspected, and certificates of freedom from injurious pests or diseases were issued to owners entitled to the same, as required by law.

Twenty-six agents of the Bureau were engaged during almost the entire year in the inspection of private orchards and the demonstration of methods to be employed for the destruction of insect pests and fungus and other diseases destructive to the fruit growing industry. More than a million trees were inspected and more than two thousand of the public demonstrations referred to were given during the year.

Many inspections were made also of imported plants and seeds for the purpose of detecting the larvae and nests of injurious insects, and in this work it was necessary at times to employ special help.

FERTILIZER CONTROL

During the year 1910, 1,482 brands of Commercial Fertilizer and fertilizing substances were registered with the Department, upon which $26,170.00 was paid and turned over to the State Treasury, as required by law.

Fourteen sampling agents were employed for a period of eight weeks, four weeks being devoted to spring and four to fall sampling.

Two thousand eight hundred and eighty-seven samples were secured and one thousand one hundred and forty-four analyses were made. In very many instances, samples of the same goods secured in different sections of the State were composited so as to reduce to a minimum the number of analyses to be made, without detracting from the efficiency of the work.

Fifteen cases were terminated during the year, for violations of the Fertilizer laws of the State, resulting in the payment of Four Hundred Dollars in fines which were paid into the Treasury of the Commonwealth.

BUREAU OF CHEMISTRY

The amount of work done by the Bureau of Chemistry during the year 1910 exceeded that of the previous year. The collection of samples of Feeding Stuffs, Paris Green and Linseed Oil, in compliance with the laws regulating the sale of these commodities, was carried on as in former years.

During the year, 1,500 samples of Feeding Stuffs were received and analyzed, and reports were made in each case to the Secretary of Agriculture, to the dealers from whom they were obtained and to the manufacturers or importers. The quality of Feeding Stuffs examined was found to be considerable better than those secured last year. The number of deficiencies was less and the adulterants found were not of such a fraudulent nature. No Feeding Stuffs were found which contained peanut shucks or rice hulls. The principal forms of

violations were false guaranteeing, the use of excessive amounts of oat hulls, cottonseed hulls and weed seeds and improper branding or labelling. Three hundred and seventy-eight registrations for the sale of Feeding Stuffs were received from manufacturers, representing approximately 1,200 brands. During the middle of December, requests and registrations blanks were sent to manufacturers and importers of Feeding Stuffs, requesting registrations for 1911. Early in the year, a Feeding Stuffs Bulletin was prepared, giving the results of analyses in 1909, together with other necessary information, and copies of these bulletins were sent out to 6,500 manufacturers of, and dealers in, Feeding Stuffs. A large number of copies of laws were also sent these parties.

A few check samples of Feeding Stuffs were from time to time sent to several chemists for comparative work. The results obtained agreed remarkably close with those found in our Bureau of Chemistry. The number of special samples of Feeding Stuffs received was 215, together with the fee of one dollar per sample. In answer to inquiries for information concerning the character of Feeding Stuffs, about 50 other special samples were examined. Twenty-five samples of milk, butter, etc., were examined for the Dairy and Food Bureau. The number of prosecutions ordered was 71. Sixty-eight were Feeding Stuff cases, two Linseed Oil, and one Paris Green. Eight of the Feeding Stuff cases were based on samples taken during the latter part of 1909. The fines and costs received in settlement of all cases amounted to Two Thousand, Eight Hundred and Nine Dollars and Forty Cents ($2,809.40). This money together with fees received for special samples was covered into the State Treasury, as required by law.

The number of samples of Paris Green received and analyzed was 417. A Paris Green Bulletin was prepared early in the year, showing the analytical results and giving other information, copies of which were sent to over 500 parties. With one exception, all samples were found to contain the required amount of arsenious oxide in combination with copper and water-soluble arsenious oxide. Many samples were found not properly labeled, but statements were received from manufacturers, advising that their goods would be properly labeled in the future.

The number of samples of Linseed Oil received and analyzed was 144. The analysis of all these has not been completed. Partial analyses already made indicate a few more adulterated samples. The principal adulterant was found to be mineral oil, ranging in amounts from 5 per cent. to 20 per cent. A bulletin will be prepared as soon as possible, giving results of the Linseed Oil work.

The office work of the Bureau has been very considerable during the year. An extra stenographer was employed for ten weeks. The amount and character of the work required of the Bureau make larger appropriations necessary for future work. An extra stenographer should be provided as soon as possible.

Improvements have been made, including a new nitrogen apparatus. A new and valuable refractometer for use in Linseed Oil work, and filing cabinets and cases have been obtained for office use. A number of valuable reference books have also been purchased.

2—7—1910

DAIRY AND FOOD BUREAU

The operations of the Dairy and Food Bureau during the year were carried forward with persistence and activity. Every branch of the work received the attention that its importance required and to those who are interested, as all should be, in the enforcement of the Pure Food Laws of the State, the detailed report of the Commissioner found in another part of this volume will prove interesting reading. To be in a position to discover violations of the law and prompt in bringing the offenders to justice have been the constant aims of this Bureau, and the work done as outlined in the report referred to will meet the approval of all who deprecate the doping of foods or the sale of food commodities that will not stand the requisite tests for purity.

It is needless that I should say anything more in relation to the respective Bureaus or Divisions of the Department than to merely call attention to the reports of the officers and agents in charge of the same, all of which appear in this general Report in their regular order.

PITTSBURG LAND SHOW

The extensive advertising given during the month of August to the Land Show to be held at Pittsburg, October 27 to 29, attracted my attention, and while the Department was not in possession of the necessary appropriation or other adequate means for making such an exhibit of our agricultural products as would do justice to the State, I felt that Pennsylvania could not afford to have this great exhibit of the products of the land of other states made within her borders, without taking part in it and making such an exhibit as would show to home seekers that they need not go outside of our State to find lands, purchasable at reasonable prices, upon which by the employment of up-to-date methods, as good results may be secured as are attainable in any other section of the country.

Accordingly, on the 7th of September, a circular was sent to members of the State Board of Agriculture, County Managers of Farmers' Institutes, Granges, Agricultural Clubs and individual farmers, asking for their assistance in getting together such an exhibit. The farmers of the State seemed to take delight in the opportunity afforded them to show their loyalty to their calling, as well as to their State and the Department, and the exhibit both in extent and quality was far beyond anything I had dared to expect or hope for. It was a source of great gratification to the many thousands of citizens of our own State that attended the show and a very great surprise to the people present from other states, who were accustomed to regard Pennsylvania as a mining and manufacturing state and were entirely unprepared for the demonstration they witnessed of her greatness as an agricultural state.

STATE COLLEGE

Closely affiliated with the Department of Agriculture, is the work of the School of Agriculture and Experiment Station of the Pennsylvania State College, and I feel that this report would be incomplete

without some reference to these helpful institutions. The only way that farmers of Pennsylvania can compete with the farmers of the other states and of other countries is by progress. Research is the foundation of all progress in agriculture. The many evidences of increased activity and usefulness of the Experiment Station, is, therefore, a source of gratification to all persons identified with the development of agriculture in Pennsylvania.

The Station has continued its co-operation with the Bureau of Farmers' Institutes and has also supplemented this work with Farmers' Weeks at the College and at other points in the State, and through educational farm trains. These agencies have been found valuable in bringing the results of the Station's investigations to the people. The Station has also offered to give a special series of lectures and have a round-table conference for the Institute lecturers at some convenient date, prior to the beginning of the season's campaign. This will serve to bring the Institute men in touch with the latest discoveries and afford them opportunity of obtaining the most accurate information possible upon questions that happen to be attracting special attention at the time.

The attempt of the College to help the people through their Correspondence Courses in Agriculture and by the introduction of Agriculture into the Public Schools is worthy of special commendation. During the past year, 3,592 persons received instruction by mail, almost as many as in the preceding three years. An inquiry develops the fact that of about 900 High Schools in the State, 155 teach some agriculture. While this is a beginning, much remains to be done, especially in getting teachers to catch the spirit of the movement. It is known that the College is endeavoring to prove the training value of agriculture as a High School subject, and it is to be sincerely hoped that rapid progress will be made.

The increase in the number of resident students in agriculture at the Pennsylvania State College has been extremely rapid, as is shown by the following table of attendance during the past five years:—

	1906–7	1907–8	1908–9	1909–10	1910–11
Four years' courses,	45	90	206	300	400
Two years' course,	14	24	41	86	112
Winter courses,	52	88	90	93	117
	111	202	337	479	629

Classification of Students in the four years' course in Agriculture.

Seniors,	3	4	16	21	35
Juniors,	5	14	25	55	78
Sophomores,	14	20	56	104	119
Freshmen,	23	51	109	131	168
	45	90	206	300	400

When, however, we reflect that possibly every year 7,000 young men in Pennsylvania engage in farming for the first time, it is obvious that when the importance of agricultural education is better understood, facilities for training in agriculture must be greatly extended within our Commonwealth.

Respectfully submitted,

N. B. Critchfield

Secretary of Agriculture.

SIXTEENTH ANNUAL REPORT OF THE DIVISION OF FARMERS' INSTITUTES FOR THE SEASON OF 1909-1910

Harrisburg, Pa., *January 1, 1911.*

To the Hon. N. B. Critchfield, *Secretary of Agriculture:*

Sir: I have the honor to present herewith the Sixteenth Annual Report of the Division of Farmers' Institutes.

INSTITUTES HELD AND ATTENDANCE

There were held in the season ending June 1, 1910, in the different counties 430 days of institute, divided into 1,061 sessions, a total attendance at which was 128,320. In addition to the regular institutes there were held 17 special institutes embracing 50 sessions with an attendance of 16,679. Movable Institute Schools were held in 11 counties continuing from four to six days in each county having an attendance of 16,697. In addition to regular and special institutes and movable schools, the Department supplied speakers at Farmers' Harvest Home Gatherings and Picnics, the attendance at which was 31,520, giving a grand total of attendance of 193,216.

As has been the practice for years past, our Annual Normal Institute was held in the city of Butler. At this meeting more than ordinary interest was manifested on the part of the instructors and the people in the problems that to-day confront agriculture. Not only was this interest deepened in the adoption of approved methods in the various lines of farm operations, but in some of the broader fields of thought, that of Domestic Economy, Home Sanitation, Adornments and Surroundings, all of which occupied a prominent place on the program, emphasizing the importance of Women's work and sphere in the Farmers' Institute.

MOVABLE SCHOOLS

The Movable Schools are developing within the farmers of Pennsylvania a more thorough knowledge of the fundamental and essential principles and practices to be followed in order to succeed in the important branch of Animal Industry as carried on by the dairy farmers of the State in selecting profitable dairy cows, their feed, care and management. In the Division of Horticulture, especially in apple and peach growing, our institutes and schools have been the forerunner in giving inspiration and encouragement to men engaged in this one of the most important industries of the State. We teach by oral demonstration, actual practice and class work, the better and more approved methods of tree selection, planting, cultivation, pruning, spraying, as well as the best manner of packing

and marketing both apples and peaches. Very largely as the result of this work through so many years Pennsylvania is forging to the front as a great fruit growing state.

POULTRY INDUSTRY

I should further state, that our Institutes early took cognizance of the importance of the Poultry Industry and we have engaged a large number of practical and skilled instructors, thus developing the best practices in housing, feeding and handling poultry in order to procure profitable results in egg production as well as for market purposes. So well have these lessons been accepted and acted upon by the people that Pennsylvania today stands in the front rank in the value of its poultry and eggs. It can be fairly stated that our fowls number 12,000,000, the value of which is $6,600,000. Whilst we have not at hand the value of egg production for 1910, reports show the number of eggs in Pennsylvania for this year was 75,400,000 dozen, the value of which was $15,600,000. These figures we believe to be below the real value of poultry and eggs rather than above, and show that within the last decade our poultry and eggs has more than doubled its value making a grand total of about $27,000,000.

AGRICULTURAL FAIRS

The Agricultural Fairs of 1910 were a marked improvement over any year of which I have knowledge. Games of chance and gambling was practically eliminated. Awards for strictly agricultural products were more general and liberal than heretofore. The attendance was 1,449,000. The Associations have a membership of 12,055 and receive from the State a fund under the Act of 1907 amounting to $27,944.50. There was paid for premiums $125,568.65, showing an increase over the previous year of $30,050.74.

For the year 1909 the crop conditions after that we have considered the extreme drouth that prevailed over all portions of the State exceeded all expectations. Fairly good crops of corn, potatoes and other cereals were produced by many farmers and especially by those who observed and carried out the approved methods of cultivation in order to develop a condition of moisture that under less practical methods would have brought failure, and whilst we have not yet completed our Crop Report for the year 1910, I feel free to state that our cereals embracing potatoes and hay will be increased from $166,173,000 to at least $170,000,000, also the value of our animals, including Poultry is expected to be increased to $180,000,000.

We are safe in saying that Pennsylvania amongst all her sister states has but little reason to complain as to the outcome of her crops and every encouragement to perservere in the adoption of approved methods in agriculture, bringing to bear the highest order of intelligence that study and research can develop in the advancement of the varied lines of farm pursuits in which we are engaged.

PENNSYLVANIA FARMERS' INSTITUTES, 1909-1910

The following is a complete list by counties, of dates and places where institutes, movable schools and special institutes were held throughout the State for the institute year ending June 1, 1910:

PENNSYLVANIA FARMERS' INSTITUTES—SEASON OF 1909-1910

County	Place	Date	Days of Institutes	Number of sessions	Attendance by Sessions	Speakers Present		Attendance		
						State	Local	Average	Total	By counties
Adams,	Bendersville,	Jan. 10-11,	2	5	50, 75, 200, 100, 225,	3	.....	130	650	.....
	Hunterstown,	Jan. 12-13,	2	5	115, 35, 200, 100, 175,	3	.....	125	625	.....
	Fairfield,	Jan. 14-15,	2	5	40, 50, 30, 65, 100,	3	.....	57	285	1,560
Allegheny,	Carnot,	Jan. 7-8,	2	4	75, 90, 200, 125, ...	4	2	120	480	.....
	Monroeville,	Jan. 10-11,	2	5	45, 35, 150, 75, 175,	4	.....	76	380	.....
	Culmerville,	Jan. 12-13,	2	5	51, 45. 145, 75, 140,	4	.....	71	356	1,316
Armstrong,	Oakland,	Jan. 17-18,	2	5	75, 35, 150, 60, 160,	3	.....	68	340	.....
	Elderton,	Jan. 19-20,	2	5	70, 80, 300, 85, 350,	3	.....	177	885	.....
	Maysville,	Jan. 21-22,	2	4	25, 45, 135, 33, ...	3	2	60	238	1,463
Beaver,	New Sheffield,	Dec. 17-18,	2	5	45, 25, 135, 50, 125,	3	1	76	380	.....
	Brighton Township,	Dec. 20-21,	2	5	86, 65, 150, 175, 240,	3	.....	140	700	.....
	Fairview,	Dec. 22-23,	2	5	40, 25, 115, 75, 145,	3	2	80	400	1,480

PENNSYLVANIA FARMERS' INSTITUTES—SEASON OF 1909-1910—Continued

County	Place	Date	Days of Institutes	Number of sessions	Attendance by Sessions	Speakers Present: State	Speakers Present: Local	Attendance: Average	Attendance: Total	Attendance: By counties
Bedford,	Osterburg,	Nov. 29-30,	2	6	24, 200, 57, 38, 30, 225,	3	2	95	572	.....
	Imlertón,	Dec. 1-2,	2	5	21, 300, 45, 48, 56,	3	1	94	470	1,042
Berks,	Huffs Church,	Dec. 23-24,	2	5	120, 230, 110, 140, 200,	5	1	160	800	.....
	Virginsville,	Feb. 23-24,	2	5	90, 200, 60, 220, 250,	5	1	164	820	.....
	Kutztown,	Feb. 28,	1	3	38, 200, 240,	5	1	159	478	.....
	Birdsboro,	Mar. 1,	1	3	50, 120, 175,	5	3	115	345	.....
	Amityville,	Mar. 4-5,	2	5	225, 400, 280, 360, 420,	8	3	337	1,685	.....
(Special),	Geigers Mills,	Oct. 16,	1	3	150, 200, 150,	1	5	167	500	4,628
Blair,	Bellwood,	Feb. 25-26,	2	5	35, 125, 40, 160, 200,	3	15	112	560	.....
	East Freedom,	Feb. 28, Mar. 1,	2	5	106, 208, 178, 200, 250,	3	8	188	940	.....
	Martinsburg,	Mar. 2-3,	2	5	50, 36, 200, 40, 300,	4	6	124	620	2,120
Bradford,			43	108	.....	84	53	.....	.....	.....
	Orwell,	Nov. 29-30,	2	5	145, 225, 375,	3	.....	176	880	.....
	Litchfield,	Dec. 1-2,	2	5	50, 100, 110, 125, 225,	3	1	122	610	.....

	East Smithfield,	Dec. 6-7,	2	5	130, 300,	90, 150,	240,	3	1	183	914	.....
	Troy,	Dec. 6-7,	2	5	130, 430,	140, 290,	100,	3	.....	218	1,090	.....
	West Franklin,	Dec. 8-9,	2	5	100, 140,	200, 200,	175,	3	1	163	815	4,309
Bucks,	Pineville,	Jan. 31, Feb. 1,	2	5	180, 500,	300, 375,	525,	5	2	376	1,880	.....
	Langhorne,	Feb. 2-3,	2	5	275, 450,	280, 400,	430,	5	1	367	1,835	.....
	Sellersville,	Feb. 4-5,	2	5	230, 350,	220, 480,	550,	5	3	366	1,830	.....
	Springtown,	Feb. 7-8,	2	5	180, 340,	220, 320,	360,	4	2	284	1,420	.....
(Special),	Line Lexington,	Oct. 2,	1	2	.....	.....	.....	2	.....	.....	5,000	11,965
Butler,	Prospect,	Feb. 14-15,	2	5	70, 200,	100, 400,	300,	3	5	214	1,010	.....
	Zelienople,	Feb. 16-17,	2	5	100, 210,	75, 500,	200,	4	3	217	1,085	.....
	Winfield, G. Hall,	Feb. 18-19,	2	5	50, 200,	18, 90,	55,	4	2	83	415	2,570
Cambria,	Salix,	Jan. 5-6,	2	6	40, 150,	215, 140,	200, 210,	5	5	159	955	.....
	Chest Springs,	Jan. 7-8,	2	5	125, 200,	75, 225,	250,	5	3	175	875	.....
	Carrolltown,	Jan. 10-11,	2	5	100, 225,	125, 200,	300,	4	3	192	950	.....
(Special),	Wilmore,	Nov. 16-17,	2	6	50, 75,	250, 75,	150, 200,	1	6,	133,	800	3,580
Cameron,	Sterling Run,	Feb. 7,	1	3	8,	20,	45,	3	.....	24	73	.....
	Rich Valley,	Feb. 9,	1	2	.....	12,	17,	3	.....	14	29	.....
	Truman,	Feb. 10,	1	3	17,	26,	60,	4	.....	34	103	.....
			1	2	.....	70,	75,	2	.....	73	145	530
Carbon,	Bowmans,	Jan. 19,20,	2	3	6,	8,	25,	4	.....	13	39	.....
	Weissport,	Jan. 21-22,	2	4	7, 13,	7,	12,	4	.....	10	39	78

PENNSYLVANIA FARMERS' INSTITUTES—SEASON OF 1909-1910—Continued

County	Place	Date	Days of Institutes	Number of sessions	Attendance by Sessions	Speakers Present		Attendance		
						State	Local	Average	Total	By counties
Center,	Aaronsburg,	Feb. 14-15,	2	5	170, 350, 225, 300, 400,	2	1	289	1,445	.....
	Center Hall,	Feb. 16-17	2	5	110, 450, 125, 350, 500,	4	.....	312	1,535	.....
	Boalsburg,	Feb. 18-19,	2	5	60, 200, 150, 250, 250,	4	1	182	910	3,890
			80	224	.....	176	93	.....	.....	.....
Chester,	Cedarville,	Feb. 18-19,	2	5	150, 135, 250, 325, 375,	4	1	247	1,235	.....
	Downingtown,	Feb. 21-22,	2	4	75, 35, 150, 160, ...	3	1	105	420	.....
	Unionville,	Feb. 23-24,	2	5	75, 175, 125, 100, 200,	3	1	135	675	.....
(Special),	Doe Run,	Feb. 11,	1	2	200, 75, ...	4	.....	138	275	.....
(Special),	Landenburg,	Aug. 27-28,	2	4	600, 700, 900, 800, ...	2	.....	740	3,000	.....
	Oxford,	Feb. 25-26,	2	4	125, 150, 125, 400, ...	3	1	200	800	.....
(Movable School),	Avondale,	Feb. 16-19,	4	10	100, 205, 85, 190, 125, 160, 70, 105, 185, 240,	6	.....	146	1,465	7,870
Clarion,	Greenville,	Feb. 11-12,	2	5	85, 152, 55, 160, 240,	4	.....	138	692	.....
	Rimersburg,	Feb. 14-15,	2	5	120, 130, 310, 290, 451,	3	1	240	1,301	.....

	Lamartine,	Feb. 16-17,	2	5	90, 182,	43, 125,	124,	3	1	114	569	2,562
Clearfield,	Grampian,	Jan. 21-22,	2	4	50, 300,	60, 200,	.....	3	4	152	610	.....
	Grass Flat,	Feb. 21-22,	2	5	30, 40,	75, 75,	110,	3	1	66	330	.....
	Bigler,	Feb. 23-24,	2	5	80, 60,	200, 200,	225,	3	1	153	765	.....
(Special),	DuBois,	Feb. 16-17,	2	3	100,	200,	250,	2	2	167	500	.....
(Special),	Hickory,	Feb. 18-19,	2	3	100,	10,0	100,	2	2	100	300	2,505
Clinton,	McElhattan,	Jan. 31, Feb. 12,	2	5	65, 180,	52, 110,	200,	3	2	121	607	.....
	Millhall,	Feb. 2-3,	2	5	70, 300,	52, 156,	170,	3	2	149	748	.....
	Loganton,	Feb. 4-5,	2	5	165, 320,	225, 350,	328,	3	1	277	1,385	2,740
Columbia,	Bloomsburg,	Jan. 10-15,	6	14	100, 125, 200, 260,	95, 1125, 110, 250,	185, 80, 200,	.....	.....	.....	.....	.....
(Movable School),	.....	.....	.....	.....	95,	115,	260,	6	.....	144	2,000	2,000
Crawford,	Little Cooley,	Feb. 25-26,	2	5	90, 190,	170, 325,	300,	4	2	215	1,075	.....
	Centreville,	Feb. 25-26,	1	3	70,	140,	125,	4	1	112	335	.....
	Conneaut Lake,	Feb. 23,	2	5	55, 65,	110, 110,	125,	3	2	91	435	.....
	Saegerstown,	Feb. 2-5,	4	11	45, 125,	165, 88,	200. 215,	.....	.....	.....	.....	.....
(Movable School),	.....	.....	.....	.....	90, 225,	290, 100,	190,	5	1	158	1,733	3,598
Cumberland,	Newburg,	Nov. 29-30,	2	5	35, 200,	40, 75,	225,	4	.....	115	575	.....
	Middlesex,	Dec. 1-2,	2	5	10, 125,	9, 27,	135,	4	1	61	306	.....
	Shepherdstown,	Dec. 3-4,	2	6	15, 65,	210, 20.	75, 250,	4	.....	106	635	.....

PENNSYLVANIA FARMERS' INSTITUTES—SEASON OF 1909-1910—Continued

County	Place	Date	Days of Institutes	Number of sessions	Attendance by Sessions	Speakers Present: State	Speakers Present: Local	Attendance: Average	Attendance: Total	Attendance: By counties
	Hogestown,	Feb. 7-10,	4	11	100, 95, 200, 125, 150, 90, 175, 125, 215, 130, 214,	------	------	------	------	------
(Movable School),			------	------		5	2	140	1,530	3,046
Dauphin,	Doedate,	Dec. 11,	1	2	16, 22, ------	3	------	19	38	------
	Hummelstown,	Dec. 13-14,	2	5	30, 25, 40, 45, 75,	3	------	43	215	------
	Berrysburg,	Dec. 15-16,	2	5	50, 40, 275, 100, 200,	3	------	133	665	918
Delaware,	Concordville,	Feb. 28, Mar. 1,	2	5	35, 30, 10, 110, 100,	3	------	57	285	------
	Newtown Square,	Mar. 2,	1	3	20, 75, 100,	2	------	65	195	------
	Media,	Mar. 3-4,	2	5	60, 30, 200, 100, 225,	3	3	123	615	1,095
Elk,	St. Marys,	Jan. 19-20,	2	5	54, 40, 110, 70, 175,	3	1	89	449	------
	Kersey,	Jan. 21-22,	2	5	25, 28, 35, 45, 50,	3	------	37	183	632
Erie,	Erie,	Jan. 31, Feb. 3,	4	10	90, 85, 205, 170, 160, 135,	------	------	------	------	------
(Movable School),			------	------	195, 170, 95, 210, ------	5	------	151	1,515	------

	Edinboro,	Mar. 1-2,	2	5	80, 130,	132, 250,	100,	3	.....	138	692	.....
	Phillipsville,	Mar. 3-4,	2	5	130, 144,	160, 186,	182,	3	.....	160	802	2,009
Fayette,	McClellantown,	Dec. 3-4,	2	5	13, 25,	140, 75,	300,	4	2	110,	553	.....
	Vanderbilt,	Dec. 6-7,	2	5	55, 50,	150, 75,	125,	4	1	89	445	.....
	Mill Run,	Dec. 8-9,	2	5	50, 45,	165, 75,	200,	4	.....	104	520	1,518
Forest,	Clarington,	Feb. 18-19,	2	5	107, 140,	82, 138,	320,	2	4	157	787	.....
	Tionesta,	Feb. 21,	1	2	90,	152,	631,	4	1	291	873	1,660
Franklin,	Dry Run,	Jan. 4-5,	2	5	135, 350,	100, 250,	350,	3	.....	237	1,185	.....
	Fayetteville,	Jan. 5-6,	2	4	140, 50,	100,	165,	3	.....	114	455	.....
	Marion,	Jan. 7-8,	2	5	90, 175,	20, 100,	250,	3	3	.....	635	2,275
			189	464	.....	.....	.....	333	138	.....	.....	.....
Fulton,	McConnellsburg,	Dec. 3-4,	2	5	46, 300,	62, 67,	350,	3	3	165	825	.....
	Ft. Littleton,	Dec. 6-7,	2	5	28, 225,	19, 28,	150,	3	1	90	450	1,275
Greene,	Rodgersville,	Nov. 29-30,	2	5	70, 105,	280, 250,	325,	3	.....	206	1,030	.....
	Carmichaels,	Dec. 1-2,	2	5	20, 125,	230, 150,	350,	3	.....	155	775	.....
(Special),	Jefferson,	Dec. 17-18,	2	5	40, 160,	30, 80,	200,	1	5	102	510	2,415
Huntingdon,	Shirleysburg,	Dec. 8-9,	2	4	80, 300,	87, 80,	.....	3	2	137	549	.....
	McAleveys Fort,	Dec. 10-11,	2	5	30, 200,	26, 91,	325,	3	2	134	672	.....
	Alexandria,	Mar. 4-5,	2	4	30, 28,	130, 42,	.....	4	3	57	230	.....
(Special),	Warriors Mark,	Mar. 7-8,	2	5	100, 300,	125, 158,	350,	3	4	206	1,033	2,484

PENNSYLVANIA FARMERS' INSTITUTES—SEASON OF 1909-1910—Continued

County	Place	Date	Days of Institutes	Number of sessions	Attendance by Sessions	Speakers Present: State	Speakers Present: Local	Attendance: Average	Attendance: Total	Attendance: By counties
Indiana,	Brush Valley,	Jan. 12-13,	2	5	150, 125, 400, 200, 200,	4	5	215	1,075	.....
	Penn Run,	Jan. 14-15,	2	5	135, 150, 210, 250, 350,	4	6	219	1,095	.....
	Rochester Mills,	Jan. 17-18,	2	5	130, 30, 300, 110, 200,	3	5	136	780	.....
	Shelocta,	Jan. 19-20,	2	5	63, 110, 240, 140, 290,	4	4	166	833	3,783
Jefferson,	Brookville,	Dec. 1-4,	4	11	125, 325, 140, 200, 210, 195,	4	.....	.....	.....	.....
(Movable School),	.....	.....	.....	.....	100, 245, 195, 115, 210,	4	.....	190	2,060	2,060
Juniata,	McAlisterville,	Dec. 17-18,	2	5	60, 127, 260, 245, 400,	3	8	218	1,092	.....
	East Waterford,	Dec. 20-21,	2	5	12, 38, 152, 157, 275,	3	2	127	634	1,726
Lackawanna,	Daleville,	Jan. 3-4,	2	5	35, 21, 90, 33, 110,	4	1	58	289	.....
	Tompkinsville,	Jan. 5-6,	2	5	26, 20, 65, 70, 140,	4	.....	64	321	.....
	Baldmount,	Jan. 7-8,	2	5	50, 60, 155, 119, 175,	4	1	112	559	.....
(Special),	Madisonville,	Jan. 10-11,	2	5	35, 90, 44, 108, 21,	2	1	59	298	.....

	Fleetville,	Jan. 12-13,	2	4	3, 25, 50,	152, 200, 105,	------	2	2	98	387	-------
	Clarks Green,	Jan. 14-15,	2	5	29,	46,	144,	2	3	75	374	2,228
Lancaster,	Quarryville,	Feb. 7-8,	2	5	100, 250,	50, 250,	300,	4	1	190	950	-------
	Lampeter,	Feb. 9-10,	2	5	175, 325,	200, 300,	350,	5	1	270	1,350	-------
	Mechanicsville,	Feb. 11-12,	2	5	75, 75,	25, 280,	300,	5	------	151	755	-------
	Maytown,	Feb. 14-15,	2	5	125, 325,	60, 400,	375,	4	------	248	1,240	-------
(Summer Inst.),			243	597	------	------	------	423	198	------	-------	-------
	Ephrata,	Feb. 16-17,	2	4	500,	150,	------	4	2	206	825	-------
	Black Barren Springs,	Sept. 1-2,	2	4	95, 150,	100, 1,000,	------	3	1	335	1,345	-------
(Special),	Terra Hill,	Sept. 18,	1	2	100,	1,000,	------	2	1	550	1,100	7,610
Lawrence,	Mt. Jackson,	Feb. 7-8,	2	5	220,	250,	375,	4	3	204	1,020	-------
	Enon Valley,	Feb. 9-10,	2	5	70, 132,	45, 150,	375,	4	3	154	772	-------
	Harlansburg,	Feb. 11-12,	2	4	85, 100,	52, 110,	------	4	2	87	349	2,141
Lebanon,	Jonestown,	Dec. 6-7,	2	5	15, 100,	25, 35,	100,	4	------	55	275	-------
	Shaefferstown,	Dec. 8-9,	2	5	60, 200,	50, 80,	225,	4	1	123	615	-------
	Campbelltown,	Dec. 10,	1	3	20,	45,	75,	4	------	47	140	-------
(Special),	Lebanon,	Oct. 9,	1	2	150,	200,	------	2	------	175	350	1,380
Lehigh,	Saegersville,	Jan. 17-18,	2	5	70, 160,	70, 120,	100,					
	Allentown,	Feb. 9-12,	4	11	85, 75,	75, 175,	160, 110,	6	2	------	-------	-------
(Movable School),			------	------	250, 65,	40, 135,	260,	------	------	127	1,400	1,920
Luzerne,	Orange,	Jan. 10-11,	2	5	110, 180,	140, 230,	325,	3	------	197	985	-------
	Lehman,	Jan. 12-13,	2	5	350,	300,	420,	3	1	275	1,375	-------
	Sweet Valley,	Jan. 12-13,	2	5	25, 40,	80, 350,	400,	2	1	179	895	3,135

PENNSYLVANIA FARMERS' INSTITUTES—SEASON OF 1909-1910—Continued

County	Place	Date	Days of Institutes	Number of sessions	Attendance by Sessions	Speakers Present: State	Speakers Present: Local	Attendance: Average	Attendance: Total	Attendance: By counties
Lycoming,	Pennsdale,	Dec. 10-11,	2	5	50, 45, 125, 120, 250,	4	------	118	590	--------
	Farragut,	Dec. 13-14,	2	5	20, 30, 12, 60, 100,	3	------	44	222	--------
	Pine Run,	Dec. 15-16,			95, 85, 120,	3	------	87	435	1,252
McKean,	Port Allegany,	Jan. 14-15,	2	4	30, 52, 45, 80, ------	3	1	52	207	--------
	Kane,	Jan. 17-18,	2	6	25, 68, 35, 54, 20, 33,	3	------	39	235	442
Mercer,	Greenville,	Jan. 31, Feb. 1,	2	5	195, 150, 127, 190, 160,	4	------	164	822	--------
	New Lebanon,	Feb. 2-3,	2	5	136, 85, 400, 130, 200,	4	1	195	971	--------
	New Virginia,	Feb. 4-5,	2	5	65, 47, 190, 98, 200,	4	1	114	570	2,363
Mifflin,	McVeytown,	Dec. 13-14,	2	5	19, 55, 80, 64, 483,	3	1	140	701	--------
	Milroy,	Dec. 15-16,	2	5	25, 30, 400, 50, 325,	3	2	166	830	1,531

			292	717				510	222			
Monroe,	Tannersville,	Dec. 20-21,	2	5	25, 60,	20, 20,	75,	3		40	200	
	Shawnee,	Dec. 22-23,	2	5	20, 50,	20, 40,	45,	3		35	175	375
Montgomery,	Centre Point,	Feb. 16-17,	2	5	100, 390,	220, 360,	240,	4	3	262	1,310	
	Schwenksville,	Feb. 18-19,	2	5	225, 325,	190, 300,	325,	4	5	273	1,365	
	East Greenville,	Feb. 21-22,	2	5	175, 320,	130, 220,	380,	4	2	264	1,320	
	Sanatoga,	Mar. 2-3,	2	5	65, 200,	80, 190,	240,	5	1	155	775	4,770
Montour,	Washingtonville,	Feb. 9-10,	2	5	80, 200,	200, 400,	500,	4		276	1,380	
	Mausdale,	Feb. 11,	1	2	60,	60,		4	1	60	120	1,500
Northampton,	Tatamy,	Feb. 9-10,	2	5	55, 65,	60, 90,	200,	3	2	94	470	
	Ackermansville,	Feb. 11-12,	4	4	70, 60,	125, 240,		3	1	99	495	
	Moorestown,	Feb. 14-15,	2	5	55, 140,	130, 150,	180,	3	2	131	655	1,620
Northumberland,	Stone Valley Church,	Feb. 2-3,	2	5	200, 500,	200, 250,	150,	4		260	1,300	
	Northumberland,	Feb. 4-5,	2	5	200, 200,	75, 100,		3		144	575	
	Dewart,	Feb. 7-8,	2	5	40, 250,	75, 225,	300,	4	1	178	890	2,765
Philadelphia,	Bustleton,	Mar. 7-8,	2	4	100, 250,	70, 250,		2	3	167	670	670
Perry,	Newport,	Dec. 17-18,	2	5	40, 90,	35, 100,	200,	3		93	465	
	Roseglen,	Dec. 20,	2	3	60,	135,	250,	3		148	445	
	Landisburg,	Dec. 21-22,	2	5	50, 250,	50, 100,	250,	3		140	700	1,610

PENNSYLVANIA FARMERS' INSTITUTES—SEASON OF 1909-1910—Continued

County	Place	Date	Days of Institutes	Number of sessions	Attendance by Sessions	Speakers Present: State	Speakers Present: Local	Attendance: Average	Attendance: Total	Attendance: By counties
Pike,	Paupack,	Dec. 15-16,	2	6	9, 70, 30, 70, 20, 80,	3	------	46	279	--------
	Greentown,	Dec. 17-18,	2	5	40, 300, 250, 60, 100,	3	------	150	750	1,029
Potter,	Gold,	Jan. 8,	1	2	55, 60, ------	3	------	58	115	--------
	North Bingham,	Jan. 10-11,	2	5	60, 50, 95, 100, 125,	3	------	86	430	--------
	Germania,	Jan. 12-13,	2	5	52, 65, 122, 57, 72,	3	------	78	388	933
Schuylkill,	Pitman,	Mar. 7-8,	2	5	280, 300, 340, 330, 350,	5	1	320	1,600	--------
	Pottsville,	Feb. 14-17,	4	11	90, 50, 250, 210, 100, 100,	------	------	------	------	--------
(Movable School),			------	------	120, 70, 240, 95, 260,	5	3	144	1,585	3,185
			342	838	------	596	247	------	------	--------
Snyder,	Beavertown,	Dec. 22-23,	2	6	53, 200, 150, 150, 75, 210,	3	2	137	823	--------
	Mt. Pleasant Mills,	Jan. 31, Feb. 1,	2	5	150, 150, 350, 225, 400,	3	2	255	1,275	2,098
Somerset,	Rockwood,	Jan. 3,	1	3	40, 100, 125,	5	------	88	265	--------
	Stoyestown,	Jan. 4-5,	2	5	39, 200, 125, 110, 118,	5	3	178	892	--------

	Somerset,	Nov. 29, Dec. 2,	2	10	50, 150, 60,	60, 100, 100,	320, 100,					
(Movable School),					120,	300,		4		136	1,360	2,517
Sullivan,	Colley,	Dec. 17-18,	2	4	120, 90,	325, 230,	400,	4		233	1,165	1,165
Susquehanna,	Thompson,	Dec. 7-8,	2	6	100, 150,	150, 100,	150,	3	1	130	650	
	South Gibson,	Dec. 9,	1	3	100,	200,	250,	3		183	550	
	Montrose,	Dec. 10,	1	2	60,	200,		3		130	260	
	Franklin Forks,	Dec. 11,	1	3	60,	100,	125,	3		95	285	
	Auburn Centre,	Dec. 13-14,	2	5	50, 200,	50, 60,	100,	3		92	460	2,205
Tioga,	Tioga,	Jan. 3-4,	2	5	50, 150,	30, 62,	100,	3		79	394	
	Westfield,	Jan. 5-6,	2	5	35, 65,	95, 40,	56,	3		58	291	
	Wellsboro,	Dec. 6-9,	4	12	25, 40,	30, 50,	60, 30,					
(Movable School),					35, 37,	42, 50,	45, 60,	4		84	504	
	Mansfield,	Dec. 8-11,	2	9	40, 60,	75, 100,	120, 215,					
(Movable School),					240, 175,	100,		4		129	1,125	2,314
Union,	Lewisburg,	Dec. 3-7,	4	10	50, 35,	40, 50,	60, 38,					
(Movable School),					45, 30,	32, 40,				42	420	
	Swengle,	Feb. 12,	4	3	40,	100,	140,	3	1	80	280	700
Venango,	Utica,	Feb. 21-22,	2	5	95, 240,	85, 310,	325,	3	3	211	1,055	
	Sunville,	Feb. 23-24,	2	5	40, 135,	140, 230,	225,	3	1	158	790	1,845

PENNSYLVANIA FARMERS' INSTITUTES—SEASON OF 1909-1910—Continued

County	Place	Date	Days of Institutes	Number of sessions	Attendance by Sessions	Speakers Present: State	Speakers Present: Local	Attendance: Average	Attendance: Total	Attendance: By counties
Warren,	Limestone,	Feb. 23-24,	2	3	75, 68, 72,	4	.....	71	215	.....
	West Spring Creek,	Feb. 25-26,	2	4	50, 68, 65, 80,	4	.....	66	263	.....
	Ackley,	Feb. 28,	1	3	35, 130, 100,	3	.....	88	265	.....
(Special),	Lauder,	Oct. 20-21,	2	4	125, 175, 250, 250,	2	.....	200	800	1,543
			389	958	.....	671	260	.....	.....	.....
Washington,	Scenery Hill,	Dec. 10-11,	2	5	30, 40, 150, 75, 250,	4	2	109	545	.....
	Finleyville,	Dec. 13-14,	2	5	25, 110, 30, 45, 60,	4	.....	26	131	.....
	W. Middletown,	Dec. 15-16,	2	5	25, 110, 30, 110, 220,	4	2	99	495	.....
(Special),	Eighty-Four,	Oct. 28,	1	2	47, 126, ...	1	.....	86	173	1,344
Wayne,	Dyberry,	Nov. 29,	1	3	40, 100, 125,	2	.....	88	265	.....
	Whites Valley,	Nov. 30,	1	3	50, 125, 150,	3	.....	108	325	.....
	Pleasant Mt.,	Dec. 1,	1	3	100, 150, 200,	3	.....	150	450	.....
	Lake Como,	Dec. 2-3,	2	5	100, 150, 50, 100, 200,	3	.....	110	550	.....
	Orson,	Dec. 4-6,	2	5	70, 50, 200, 100, 200,	3	.....	125	625	2,215
Westmoreland,	New Madison,	Jan. 3-4,	2	5	35, 30, 60, 38, 65,	3	.....	46	228	.....

	New Alexandria,	Jan. 5-6,	2	5	60, 120,	60, 125,	135,	3	3	100	500	.....
	New Kensington,	Jan. 4-5,	2	5	45, 50,	60, 70,	60, ...	4	.....	57	285	.....
	Scottdale,	Jan. 24-25,	2	5	135, 300,	165, 325,	400,	3	.....	265	1,325	2,338
Wyoming,	Tunkhannock,	Dec. 20-21,	2	5	50, 110,	125, 325,	400, ...	4	3	202	1,010	.....
	Laceyville,	Dec. 22-23,	2	5	65, 50,	170, 100,	146,	4	1	106	531	1,541
York,	Stewartstown,	Jan. 17-18,	2	6	25, 150,	175, 250,	450, 300,	4	4	225	1,350	.....
	New Freedom,	Jan. 19-20,	2	5	135, 300,	100, 300,	350,	4	.....	237	1,185	.....
	Seven Valleys,	Jan. 21-22,	2	5	20, 20,	100, 100,	450,	4	.....	128	640	.....
	Lewisberry,	Jan. 31, Feb. 1,	2	5	200, 450,	200, 400,	500,	3	3	350	1,750	.....
	Dover,	Feb. 2-3,	2	6	100, 250,	500, 135,	400, 550,	4	.....	323	1,935	.....
	Spry,	Feb. 4-5,	2	5	75, 200,	50, 125,	350,	4	.....	180	800	.....
(Special),	Wild Cat Falls,	Sept. 30,	1	1	50,	.....	.....	1	.....	50	50	.....
(Special),	Newberry,	Aug. 7,	1	2	300,	400,	.....	2	2	350	700	.....
(Special),	Felton,	Aug. 19,	1	2	500,	800,	....	1	2	650	1,300	9,710
Total,			459	1,061	.....	.....	.....	746	282	.....	.....	161,696

Attendance at Regular Institutes,	128,320
Special Institutes,	16,679
Movable Schools,	16,697
Farmers' Picnics,	31,520
Total,	193,216

MEETING OF THE FARMERS' ANNUAL NORMAL INSTITUTE, BUTLER, PA.

PROGRAM.

First Session Convenes Tuesday Afternoon, May 24, 1910.

MR. N. F. BARTLEY, Euclid, Pa., Chairman.

Call to order 1.30.

Address of Welcome, by Judge James M. Galbraith, Butler, Pa.

Responses, by Messrs. L. W. Lighty, East Berlin, Pa.

R. P. Kester, Grampian, Pa.

1. "THE FARMER A MANUFACTURER."

Prof. Franklin Menges, York, Pa.

Note: After each topic is presented, 15 minutes will be occupied in general discussion.

Tuesday Evening, May 24, 1910.

MR. SYLVESTER SHAFFER, New Castle, Pa., Chairman.

Call to order 7.30.

1. "THE STARTING OF AN ORCHARD."

Prof. W. J. Green, Wooster, Ohio.

2. "SPRAYING, THE SHEET-ANCHOR OF SUCCESS."

Dr. J. H. Funk, Boyertown, Pa.

3. "FERTILIZATION AND CULTURAL METHODS FOR APPLE ORCHARDS."

Prof. J. P. Stewart, State College, Pa.

(Illustrated by lantern slides.)

Wednesday Morning, May 25, 1910

MR. W. C. BLACK, Mercer, Pa., Chairman.

Call to order 9.00.

1. "PROFITABLE BREEDING AND FEEDING OF BEEF CATTLE."

Mr. O. E. Bradfute, Xenia, Ohio.

2. "BEEF CATTLE; THEIR RELATION TO AGRICULTURE IN PENNSYLVANIA."

Prof. W. A. Cochel, State College, Pa.

3. "CONTROL OF INFECTIOUS DISEASES OF ANIMALS."

Dr. S. H. Gilliland, State Veterinarian, Harrisburg, Pa.

Wednesday Afternoon, May 25, 1910.

MR. W. A. CRAWFORD, Cooperstown, Pa., Chairman.

Call to order 1.30.

1. "PRACTICAL METHODS OF POTATO GROWING."

Mr. E. A. Rogers, Brunswick, Maine.

POULTRY INDUSTRY:

2. "SOME MODERN POULTRY PROBLEMS."

Mr. J. T. Campbell, Hartstown, Pa.

3. "SOME REASONS FOR POOR HATCHES."

Mr. W. Theo. Wittman, Allentown, Pa.

Wednesday Evening, May 25, 1910.

MR. S. S. BLYHOLDER, Neale, Pa., Chairman.

Call to order 7.30.

1. "THE FARMER AND HIS RECREATION."

Rev. Enos H. Hess, Lancaster, Pa.

2. "EDUCATIONAL UTILITY."

Dr. Edwin E. Sparks, President State College, State College, Pa.

3. "AGRICULTURE IN SOUTH AMERICA."

Prof. E. M. Baxter, Mifflinburg, Pa.

(Illustrated with lantern slides.)

Thursday Morning, May 26, 1910.

MR. H. M. GOODERHAM, Patton, Pa., Chairman.

Call to order 9.00.

1. "ECONOMICAL MILK PRODUCTION."

Prof. Edwin Van Alstyne, Kinderhook, N. Y.

2. "THE PROTEIN REQUIREMENTS OF THE DAIRY COW."

Prof. Wells W. Cooke, U. S. Dept. of Agriculture, Washington, D. C.

3. "COW TESTING ASSOCIATIONS."

Mr. Helmer Rabild, U. S. Dept. of Agriculture, Washington, D. C.

Thursday Afternoon, May 26, 1910.

MR. HOWARD COX, Bellwood, Pa., Chairman.

Call to order 1.30.

GENERAL FARMERS' INSTITUTE SESSION:

1. "THE REQUISITES OF A GOOD INSTITUTE WORKER."

Prof. Edwin Van Alstyne, Kinderhook, N. Y.

2. "WHAT CONSTITUTES A GOOD COUNTY CHAIRMAN OF INSTITUTES."

Hon. Howard G. McGowan, Geiger's Mills, Pa.

Note: This session will be devoted to the general work of Farmers' Institutes throughout the State. The discussion is open to County Chairmen, Institute Lecturers and others. Not longer than five minutes can be allotted to one speaker, other than the opening addresses.

Thursday Evening, May 26, 1910.

MRS. MARTHA E. MARTIN, Harrisburg, Pa., President.

Call to order 7.30.

WOMAN'S SESSION:

1. "MOTHERS AS CHUMS."

Miss Arabella Carter, No. 1305 Arch St., Philadelphia, Pa.

2. "DOMESTIC SCIENCE AND HIGH COST OF LIVING."

Miss Sara C. Lovejoy, State College, Pa.

3. "WOMEN'S SHARE IN AGRICULTURE."

Miss Martha Van Rensselaer, Ithaca, N. Y.

Friday Morning, May 27, 1910.

MR. M. P. SHOEMAKER, Greensburg, Pa., Chairman.

Call to order 9.00.

1. "DIFFICULTIES ENCOUNTERED IN ENFORCING THE PURE FOOD LAWS."

Mr. James Foust, Dairy and Food Commissioner, Harrisburg, Pa.

2. "SOME THINGS OUTSIDE THE FARMYARD GATE."

Mr. Fred W. Card, Sylvania, Pa.

3. "HOW TO RAISE CROPS WITHOUT WEEDS."

Dr. J. D. Detrich, No. 438 Adams Avenue, Scranton, Pa.

Closing Remarks and Adjournment.

LIST OF COUNTY INSTITUTE MANAGERS FOR SEASON OF 1909-10

County.	Name and Address of Chairmen.
Adams,	A. I. Weidner, Arendtsville.
Allegheny,	A. J. Purdy, Imperial, R. F. D.
Armstrong,	S. S. Blyholder, Kelly Station.
Beaver,	A. L. McKibben, New Sheffield.
Bedford,	David W. Lee, Bedford.
Berks,	Howard G. McGowan, Geiger's Mills.
Blair,	Howard Cox, Bellwood,
Bradford,	F. D. Kerrick, Towanda, R. F. D. No. 9.
Bucks,	Watson T. Davis, Ivyland.
Butler,	N. F. Bartley, Euclid.
Cambria,	H. M. Gooderham, Patton, R. F. D. No. 1.
Carbon,	.....
Center,	L. E. Stover, Aaronsburg; Leonard Rhone, Center Hall; E. W. Sweeney, Boalsburg, Local Chairmen.
Cameron,	W. H. Howard, Emporium.
Chester,	Dr. M. E. Conard, Westgrove.
Clarion,	S. X. McClellan, Knox.
Clearfield,	Peter Gearhart, Clearfield.
Clinton,	Joel A. Herr, Millhall, R. F. D.
Columbia,	A. P. Young, Millville.
Cumberland,	T. J. Ferguson, Mechanicsburg.
Crawford,	J. F. Seavy, Saegerstown.
Dauphin,	S. F. Barber, Harrisburg.
Delaware,	E. J. Durnall, Swarthmore.
Elk,	J. B. Werner, St. Mary's.
Erie,	Archie Billings, Edinboro.
Fayette,	T. H. Smith, Dunbar, R. F. D. No. 32.
Forest,	C. A. Randall, Tionesta.
Franklin,	J. P. Young, Marion.
Fulton,	J. L. Patterson, McConnellsburg.
Greene,	J. W. Stewart, Jefferson.
Huntingdon,	G. G. Hutchison, Warrior's Mark.
Indiana,	S. C. George, West Lebanon.
Jefferson,	Peter B. Cowan, Brookville.

County.	Name and Address of Chairmen.
Juniata,	Matthew Rodgers, Mexico.
Lackawanna,	Horace Seamans, Factoryville.
Lancaster,	J. Aldus Herr, Lancaster, R. F. D.
Lawrence,	Sylvester Shaffer, New Castle, R. F. D. No. 3.
Lebanon,	Edwin Shuey, Lickdale.
Lehigh,	P. S. Fenstermaker, Allentown.
Lycoming,	A. J. Kahler, Hughesville.
Luzerne,	J. E. Hildebrant, Dallas, R. F. D.
McKean,	O. W. Abbey, Tuttle Point.
Mercer,	W. C. Black, Mercer.
Mifflin,	M. M. Naginey, Milroy.
Monroe,	F. S. Brong, Saylorsburg.
Montgomery,	Jason Sexton, North Wales.
Montour,	J. Miles Derr, Milton, R. F. D. No. 1.
Northampton,	C. S. Messinger, Tatamy.
Northumberland,	I. A. Eschbach, Milton, R. F. D. No. 1.
Perry,	A. T. Holman, Millerstown.
Philadelphia,	J. B. Kirkbride, Bustleton.
Pike,	B. F. Killam, Paupack.
Potter,	H. H. Hall, Ellisburg.
Schuylkill,	W. H. Stout, Pinegrove.
Snyder,	Chas. Miller, Salem.
Somerset,	J. C. Weller, Rockwood, R. F. D. No. 2.
Sullivan,	E. R. Warburton, Campbellsville.
Susquehanna,	F. E. Davies, Montrose.
Tioga,	E. B. Dorsett, Mansfield.
Union,	J. Newton Glover, Vicksburg.
Venango,	W. A. Crawford, Cooperstown.
Warren,	Geo. A. Woodside, Sugargrove.
Washington,	D. S. Taylor, Burgettstown.
Wayne,	W. E. Perham, Pleasant Mt., R. F. D. No. 3.
Westmoreland,	M. P. Shoemaker, Greensburg.
Wyoming,	D. A. Knuppenburg, Lake Carey.
York,	G. F. Barnes, Rossville.

LIST OF INSTITUTE LECTURERS FOR SEASON OF 1909-10

Agee, Prof. Alva, State College, Pa.
Anderson, H. M., New Park, Pa.
Baker, Miss Adaline C., Kennett Square, Pa.
Bond, M. S., Danville, Pa.
Bruckart, J. W., Lititz, Pa.
Callahan, Ellery E., Ferenbaugh, N. Y.
Campbell, J. T., Hartstown, Pa.
Card, Fred W., Sylvania, Pa.
Carter, Miss Arabella, No. 1305 Arch St., Philadelphia, Pa.
Clark, M. N., Claridge, Pa.
Conard, Dr. M. E., Westgrove, Pa.
Cooke, Prof. Wells W., U. S. Dept. of Agriculture, Washington, D. C.
Cornman, Chas. T., Carlisle, Pa.
Cox, John W., New Wilmington, Pa.
Detrich, Dr. J. D., No. 438 Adams Ave., Scranton, Pa.
Dockey, Elmer E., Elizabethville, Pa., R. F. D.
Doty, S. W., State College, Pa.
Dorsett, E. B., Mansfield, Pa.
Drake, W. M. C., Volant, Pa.
Eschbach, I. A., Milton, Pa., R. F. D. No. 1.
Fassett, F. H., Meshoppen, Pa.
Funk, Dr. J. H., Boyertown, Pa.
Gardner, Prof. Frank D., State College, Pa.
Gooderham, H. M., Patton, Pa., R. F. D.
Herr, Joel A., Millhall, Pa., R. F. D.
Herr, Prof. John D., Division of Economic Zoologist, Harrisburg, Pa.
Hoover, E. S., Lancaster, Pa., R. F. D.
Hull, Geo. E., Transfer, Pa., R. F. D.
Jackson, Homer W., State College, Pa.
Kahler, A. J., Hughesville, Pa.
Kester, R. P., Grampian, Pa.
Larson, C. W., State College, Pa.
Ledy, J. H., Marion, Pa.
Lighty, L. W., East Berlin, Pa.
Lovejoy, Miss Sara C., State College, Pa.

Mairs, Prof. T. I., State College, Pa.
McCurdy, Clarence C., Hartstown, Pa.
McDowell, M. S., State College, Pa.
Menges, Prof. Franklin, York, Pa.
Myers, Prof. C. E., State College, Pa.
Noll, Prof. Chas. F., State College, Pa.
Northup, Henry W., Dalton, Pa., R. F. D. No. 1.
Orr, Mrs. T. E., Beaver, Pa.
Owens, Prof. Wm. G., Lewisburg, Pa.
Peachey, J. H., Belleville, Pa.
Penny, Prof. Chas. L., State College, Pa.
Philips, T. J., Atglen, Pa.
Phillips, E. L., New Bethlehem, Pa., R. F. D. No 2
Phillipy, Dr. W. T., Carlisle, Pa.
Pillsbury, Dr. J. P., State College, Pa.
Posten, B. Monroe, Sheakleyville, Pa.
Rich, Chas. H., Woolrich, Pa.
Ross, A. B., Bedford, Pa.
Seeds, Robt. S., Birmingham, Pa.
Shaw, Prof. Chas. F., State College, Pa.
Stephens, A. Woodward, Hebron, Ohio.
Stewart, Prof. J. P., State College, Pa.
Stout, W. H., Pinegrove, Pa.
Thomas, Miss Sara Phillips, Wayne, R. F. D. No. 1.
Van Norman, Prof. H. E., State College, Pa.
Van Noy, Leon Otice, Troy, Pa., R. F. D. No. 3.
Wallace, Mrs. Mary A., Beechwood and Shaw Aves., Pittsburg, Pa.
Watts, Prof. R. L., State College, Pa.
Watts, D. H., Kerrmoor, Pa.
Weld, R. J., Sugargrove, Pa.
Wittman, W. Theo., Allentown, Pa.
Wolff, Wm. H., No. 116 North 51st St., Philadelphia, Pa.
Woodman, S. Paul, Rushland, Pa.
Zeigler, Mrs. Sarah B. F., Duncannon, Pa.

THE FOLLOWING IS A LIST OF SPEAKERS AND THEIR ASSIGNMENTS, ALSO BIOGRAPHICAL SKETCH OF THEIR LIVES, SEASON OF 1909-10

PROF. ALVA AGEE, State College, Centre County, Pa.

Town.	County.	Dates.
Quarryville,	Lancaster,	Feb. 7-8.
Lampeter,	Lancaster,	Feb. 9-10.
Mechanicsville,	Lancaster,	Feb. 11-12.

H. M. ANDERSON, New Park, York County, Pa.

Dewart,	Northumberland,	Feb. 7-8.
Washingtonville,	Montour,	Feb. 9-10.
Mausdale,	Montour,	Feb. 11.
Swengel,	Union,	Feb. 12.

MISS ADALINE C. BAKER, Kennett Square, Chester County, Pa.

Daleville,	Lackawanna,	Jan. 3-4.
Tompkinsville,	Lackawanna,	Jan. 5-6.
Bald Mount,	Lackawanna,	Jan. 7-8.

M. S. BOND, Danville, Montour County, Pa.

Bendersville,	Adams,	Jan. 10-11.
Hunterstown,	Adams,	Jan. 12-13.
Fairfield,	Adams,	Jan. 14-15.

J. W. BRUCKART, Litiz, Lancaster County, Pa.

Osterburg,	Bedford,	Nov. 29-30.
Imlerton,	Bedford,	Dec. 1-2.
McConnellsburg,	Fulton,	Dec. 3-4.
Shirleysburg,	Fulton,	Dec. 6-7.
Ft. Littleton,	Huntingdon,	Dec. 8-9.
McAlevys Fort,	Huntingdon,	Dec. 10-11.

E. E. CALLAHAN, Wellsboro, Tioga County, Pa.

Zelienople,	Butler,	Feb. 16-17.
Winfield Grange Hall,	Butler,	Feb. 18-19.
Utica,	Venango,	Feb. 21-22.
Sunville,	Venango,	Feb. 23-24.

J. T. CAMPBELL, Hartstown, Crawford County, Pa.

Will attend all meetings in the Third Section.

FRED. W. CARD, Sylvania, Bradford County, Pa.

Will attend all meetings in the Second Section from November 29 to December 11; First Section from December 13 to 22; Fourth Section from January 3-22.

MISS ARABELLA CARTER, No. 1305 Arch street, Philadelphia, Pa.

Town.	County.	Dates.
Quarryville,	Lancaster,	Feb. 7-8.
Lampeter,	Lancaster,	Feb. 9-10.
Mechanicsville,	Lancaster,	Feb. 11-12.
Maytown,	Lancaster,	Feb. 14-15.
Ephrata,	Lancaster,	Feb. 16-17.
Cedarville,	Chester,	Feb. 18-19.

M. N. CLARK, Claridge, Westmoreland County, Pa.

Elderton,	Armstrong,	Jan. 17-18.
Oakland,	Armstrong,	Jan. 19-20.
Marysville,	Armstrong,	Jan. 21-22.
Prospect,	Butler,	Feb. 14-15.
Zelienople,	Butler,	Feb. 16-17.
Winfield Grange Hall,	Butler,	Feb. 18-19.

THOS. W. CONWAY, Oakdale, Allegheny County, Pa.

Osterburg,	Bedford,	Nov. 29-30.
Imlerton,	Bedford,	Dec. 1-2.
McConnellsburg,	Fulton,	Dec. 3-4.
Ft. Littleton,	Fulton,	Dec. 6-7.
Shirleysburg,	Huntingdon,	Dec. 8-9.

DR. M. E. CONARD, Westgrove, Chester County, Pa.

Will attend the Movable Schools from November 29 to December 9; January 10 to January 13; January 31 to February 19.

PROF. WELLS W. COOKE, U. S. Department of Agriculture, Washington, D. C.

Will attend the Movable Schools from January 31 to February 19.

CHAS. T. CORMAN, Carlisle, Cumberland County, Pa.

Bloomsburg,	Columbia,	Jan. 14-15.
Erie,	Erie,	Feb. 2-3.
Saegerstown,	Crawford,	Feb. 4-5.
Sterling Run,	Cameron,	Feb. 7.
Sizerville,	Cameron,	Feb. 8.
Rich Valley,	Cameron,	Feb. 9.
West Creek,	Cameron,	Feb. 10.
Greenville,	Clarion,	Feb. 11-12.
Reimersburg,	Clarion,	Feb. 14-15.
Salem,	Clarion,	Feb. 16-17.
Clarington,	Forest,	Feb. 18-19.

JOHN W. COX, New Wilmington, Lawrence County, Pa.

Town.	County.	Dates.
New Alexandria,	Westmoreland,	Jan. 3-4.
Madison,	Westmoreland,	Jan. 5-6.
Carnot,	Allegheny,	Jan. 7-8.
Monroeville,	Allegheny,	Jan. 10-11.
Culmerville,	Allegheny,	Jan. 12-13.
New Kensington,	Westmoreland,	Jan. 14-15.

DR. J. D. DETRICH, No. 438 Adams Avenue, Scranton, Pa.

Greenville,	Mercer,	Jan. 31-Feb. 1.
New Lebanon,	Mercer,	Feb. 2-3.
New Virginia,	Mercer,	Feb. 4-5.
Mt. Jackson,	Lawrence,	Feb. 7-8.
Enon Valley,	Lawrence,	Feb. 9-10.
Harlansburg,	Lawrence,	Feb. 11-12.
Prospect,	Butler,	Feb. 14-15.
Pottsville,	Schuylkill,	Feb. 16-17.

ELMER E. DOCKEY, Elizabethville, R. F. D., Dauphin County, Pa.

Aaronsburg,	Centre,	Feb. 14-15.
Center Hall,	Centre,	Feb. 16-17.
Boalsburg,	Centre,	Feb. 18-19.

S. W. DOTY, State College, Centre County, Pa.

Ackley,	Warren,	Feb. 28.
Edinboro,	Erie,	March 1-2.
Harbor Creek,	Erie,	March 3-4.

E. B. DORSETT, Mansfield, Tioga County, Pa.

Reimersburg,	Clarion,	Feb. 14-15.
Salem,	Clarion,	Feb. 16-17.
Clarington,	Forest,	Feb. 18-19.
Tionesta,	Forest,	Feb. 21-22.
Grange Hall,	Warren,	Feb. 23-24.
Spring Creek,	Warren,	Feb. 25-26.

W. M. C. DRAKE, Volant, Lawrence County, Pa.

McElhattan,	Clinton,	Jan. 31, Feb. 1.
Millhall,	Clinton,	Feb. 2-3.
Logantown,	Clinton,	Feb. 4-5.
Sterling Run,	Cameron,	Feb. 7.
Sizerville,	Cameron,	Feb. 8.
Richvalley,	Cameron,	Feb. 9.
Westcreek,	Cameron,	Feb. 10.
Greenville,	Clarion,	Feb. 11-12.

I. A. ESCHBACH, Milton, R. F. D. No. 1, Northumberland County, Pa.

Town.	County.	Dates.
Sterling Run,	Cameron,	Feb. 7.
Sizerville,	Cameron,	Feb. 8.
Richvalley,	Cameron,	Feb. 9.
West Creek,	Cameron,	Feb. 10.
Greenville,	Clarion,	Feb. 11-12.

F. H. FASSETT, Meshoppen, Wyoming County, Pa.

Elderton,	Armstrong,	Jan. 17-18.
Oakland,	Armstrong,	Jan. 19-20.
Maysville,	Armstrong,	Jan. 21-22.
Springtown,	Bucks,	Feb. 7-8.
Tatamy,	Northampton,	Feb. 9-10.
Ackermanville,	Northampton,	Feb. 11-12.
Moorestown,	Northampton,	Feb. 14-15.
Centre Point,	Montgomery,	Feb. 16-17.
Schwenksville,	Montgomery,	Feb. 18-19.

DR. J. H. FUNK, Boyertown, Berks County, Pa.

Will attend Movable Schools from December 1 to December 11; Fifth Section, December 13 to January 13; Movable Schools, January 14-15; Movable Schools, February 2 to February 17; Second Section, February 18 to March 5.

PROF. FRANK D. GARDNER, State College, Centre County, Pa.

East Freedom,	Blair,	Feb. 28-Mar. 1.
Martinsburg,	Blair,	March 2-3.
Alexandria,	Huntingdon,	March 4-5.

H. M. GOODERHAM, Patton, R. F. D. Cambria County, Pa.

Shelocta,	Indiana,	Jan. 17-18.
Smicksburg,	Indiana,	Jan. 19-20.
Grampian,	Clearfield,	Jan. 21-22.
East Greenville,	Montgomery,	Feb. 21-22.
Huffs Church,	Berks,	Feb. 23-24.
Virginsville,	Berks,	Feb. 25-26.
Kutztown,	Berks,	Feb. 28.
Birdsboro,	Berks,	Mar. 1.
Sanatoga,	Montgomery,	Mar. 2-3.
Amityville,	Berks,	Mar. 4-5.
Pitman,	Schuylkill,	Mar. 7-8.

JOEL A. HERR, Millhall, R. F. D., Clinton County, Pa.

Carrolltown,	Cambria,	Jan. 10-11.
Mechanicsburg,	Indiana,	Jan. 12-13.
Greenville,	Indiana,	Jan. 14-15.
Shelocta,	Indiana,	Jan. 17-18.
Smicksburg,	Indiana,	Jan. 19-20.
Grampian,	Clearfield,	Jan. 21-22.

JOHN D. HERR, Lancaster, Lancaster County, Pa.

Town.	County.	Dates.
Dry Run,	Franklin,	Jan. 3-4.
Fayetteville,	Franklin,	Jan. 5-6.
Marion,	Franklin,	Jan. 7-8.
Mt. Pleasant Mills,	Snyder,	Jan. 31-Feb. 1.
Stone Valley Church,	Northumberland,	Feb. 2-3.
Northumberland,	Northumberland,	Feb. 4-5.
Dewart,	Northumberland,	Feb. 7-8.
Washingtonville,	Montour,	Feb. 9-10.
Mausdale,	Montour,	Feb. 11.
Swengel,	Union,	Feb. 12.
Aaronsburg,	Centre,	Feb. 14-15.
Center Hall,	Centre,	Feb. 16-17.

E. S. HOOVER, Lancaster, R. F. D. No. 3, Lancaster County, Pa.

Colley,	Sullivan,	Dec. 17-18.
Tunkhannock,	Wyoming,	Dec. 20-21.
Laceyville,	Wyoming,	Dec. 22-23.
Dover,	York,	Feb. 2-3.
Spry,	York,	Feb. 4-5.

GEO. E. HULL, Transfer, R. F. D., Mercer County, Pa.

Ackley,	Warren,	Feb. 28.
Edinboro,	Erie,	Mar. 1-2.
Barbor Creek,	Erie,	Mar. 3-4.

HOMER W. JACKSON, Cambridge, Ohio, R. F. D.

Orwell,	Bradford,	Nov. 29-30.
Litchfield,	Bradford,	Dec. 1-2.
Smithfield,	Bradford,	Dec. 3-4.
Troy,	Bradford,	Dec. 6-7.
West Franklin,	Bradford,	Dec. 8-9.
Near Halls,	Lycoming,	Dec. 10-11.
Montoursville,	Lycoming,	Dec. 13-14.
Level Corners,	Lycoming,	Dec. 15-16.
New Sheffield,	Beaver,	Dec. 17-18.
Fairview,	Beaver,	Dec. 20-21.
Grange Hall, Brighton, township,	Beaver,	Dec. 22-23.

A. J. KAHLER, Hughesville, Lycoming County, Pa.

Pineville,	Bucks,	Jan. 31-Feb. 1.
Langhorne,	Bucks,	Feb. 2-3.
Sellersville,	Bucks,	Feb. 4-5.

R. P. KESTER, Grampian, Clearfield County, Pa.

Will attend all meetings in the Third Section.

J. H. LEDY, Marion, Franklin County, Pa.

Town.	County.	Dates.
Rockwood,	Somerset,	Jan. 3.
Stoyestown,	Somerset,	Jan. 4.
Salix,	Cambria,	Jan. 5-6.
Chest Springs,	Cambria,	Jan. 7-8.
Carrolltown,	Cambria,	Jan. 10-11.
Mechanicsburg,	Indiana,	Jan. 12-13.
Greenville,	Indiana,	Jan. 14-15.

C. W. LARSON, State College, Centre County, Pa.

Lewisburg,	Union,	Dec. 3-4.
Bloomsburg,	Columbia,	Jan. 10-11.
Erie,	Erie,	Jan. 31-Feb. 1.
Saegerstown,	Crawford,	Feb. 23.

MISS SARA C. LOVEJOY, State College, Centre County, Pa.

Somerset,	Somerset,	Dec. 1-2.
Lewisburg,	Union,	Dec. 6-7.
Aaronsburg,	Centre,	Feb. 15.
Center Hall,	Centre,	Feb. 17.
Boalsburg,	Centre,	Feb. 19.

L. W. LIGHTY, East Berlin, Adams County, Pa.

Will attend all meetings in the Fifth Section.

PROF. T. I. MAIRS, State College, Centre County, Pa.

Kutztown,	Berks,	Feb. 28.
Birdsboro,	Berks,	Mar. 1.
Sanatoga,	Montgomery,	Mar. 2-3.
Amityville,	Berks,	Mar. 4-5.
Pitman,	Schuylkill,	Mar. 7-8.

CLARENCE C. McCURDY, Hartstown, Crawford County, Pa.

Tionesta,	Forest,	Feb. 21-22.
Grange Hall, Limestone,	Warren,	Feb. 23-24.
Spring Creek,	Warren,	Feb. 25-26.
Ackley,	Warren,	Feb. 28.
Edinboro,	Erie,	Mar. 1-2.
Harbor Creek,	Erie,	Mar. 3-4.

M. S. McDOWELL, State College, Centre County, Pa.

Will attend all meetings in the Third Section from January 31 to March 2.

PROF. FRANKLIN MENGES, York, York County, Pa.

Will attend all meetings in the Fourth Section.

CHAS. F. NOLL, State College, Centre County, Pa.

Town.	County.	Dates.
Tionesta,	Forest,	Feb. 21-22.
Grange Hall, Limestone,	Warren,	Feb. 23-24.
Spring Creek,	Warren,	Feb. 25-26.

C. E. MYERS, State College, Centre County, Pa.

Newburg,	Cumberland,	Nov. 29-30.
Middlesex,	Cumberland,	Dec. 1-2.
Shepherdstown,	Cumberland,	Dec. 3-4.
Jonestown,	Lebanon,	Dec. 6-7.
Schaefferstown,	Lebanon,	Dec. 8-9.
Campbelltown,	Lebanon,	Dec. 10.
Deodate,	Dauphin,	Dec. 11.

HENRY W. NORTHUP, Dalton, R. F. D. No. 1, Lackawanna County, Pa.

Will attend all meetings in the Third Section from November 29 to December 16; Second Section from December 17 to 23, and in the First Section from January 17 to February 5.

PROF. WM. G. OWENS, Lewisburg, Union County, Pa.

Hummelstown,	Dauphin,	Dec. 13-14.
Berrysburg,	Dauphin,	Dec. 15-16.
Landisburg,	Perry,	Dec. 17-18.
Roseglen,	Perry,	Dec. 19.
Newport,	Perry,	Dec. 21-22.

MRS. T. E. ORR, Beaver, Beaver County, Pa.

Carnot,	Allegheny,	Jan. 7-8.
Monroeville,	Allegheny,	Jan. 10-11.
Culmerville,	Allegheny,	Jan. 12-13.
New Kensington,	Westmoreland,	Jan. 14-15.
Little Cooley,	Crawford,	Feb. 25-26.
Centerville,	Crawford,	Feb. 28.
Conneaut Lake,	Crawford,	Mar. 1-2.

J. H. PEACHEY, Belleville, Mifflin County, Pa.

Will attend all meetings in the First Section.

PROF. CHAS. L. PENNY, State College, Centre County, Pa.

Bendersville,	Adams,	Jan. 10-11.
Hunterstown,	Adams,	Jan. 12-13.
Fairfield,	Adams,	Jan. 14-15.

T. J. PHILIPS, Atglen, Chester County, Pa.

Tannersville,	Monroe,	Dec. 20-21.
East Stroudsburg,	Monroe,	Dec. 22-23.
Kregsville,	Monroe,	Dec. 24.

E. L. PHILLIPS, New Bethlehem, Clarion County, Pa.

Town.	County.	Dates.
Rodgersville,	Greene,	Nov. 29-30.
Carmichaels,	Greene,	Dec. 1-2.
McClellantown,	Fayette,	Dec. 3-4.
Vanderbilt,	Fayette,	Dec. 6-7.
Mill Run,	Fayette,	Dec. 8-9.
Scenery Hill,	Washington,	Dec. 10-11.

DR. W. T. PHILLIPY, Carlisle, Cumberland County, Pa.

Kylertown,	Clearfield,	Feb. 21-22.
Bigler,	Clearfield,	Feb. 23-24.
Bellwood,	Blair,	Feb. 25-26.
East Freedom,	Blair,	Feb. 28-Mar. 1.
Martinsburg,	Blair,	Mar. 2-3.
Alexandria,	Huntingdon,	Mar. 4-5.

B. MONROE POSTEN, Sheakleyville, Mercer County, Pa.

Tannersville,	Monroe,	Dec. 20-21.
East Stroudsburg,	Monroe,	Dec. 22-23.
Kregsville,	Monroe,	Dec. 24.

CHAS. H. RICH, Woolrich, Clinton County, Pa.

McVeytown,	Mifflin,	Dec. 13-14.
Milroy,	Mifflin,	Dec. 15-16.
McAlisterville,	Juniata,	Dec. 17-18.

A. B. ROSS, Schellsburg, Bedford County, Pa.

Daleville,	Lackawanna,	Jan. 3-4.
Tompkinsville,	Lackawanna,	Jan. 5-6.
Bald Mount,	Lackawanna,	Jan. 7-8.

R. F. SCHWARZ, Analomink, Monroe County, Pa.

Will attend all meetings in the Fifth Section from November 29 to December 11; Third Section from December 13 to December 23, and the First Section from January 31 to March 7.

ROBT. S. SEEDS, Birmingham, Huntingdon County, Pa.

Will attend all meetings in the First Section from January 3 to January 8; Fifth Section from January 10 to January 22, and the Second Section from January 31 to February 5.

PROF. CHAS. F. SHAW, State College, Centre County, Pa.

Pineville,	Bucks,	Jan. 31-Feb. 1.
Langhorne,	Bucks,	Feb. 2-3.
Sellersville,	Bucks,	Feb. 4-5.

A. W. STEPHENS, Lewisburg, Union County, Pa.

Will attend all meetings in the Third Section from January 31 to February 12, and the First Section from February 14 to March 8.

PROF. J. P. STEWART, State College, Centre County, Pa.

Town.	County.	Dates.
Sweet Valley,	Luzerne,	Jan. 14-15.
Saegerstown,	Lehigh,	Jan. 17-18.
Bowman,	Lehigh,	Jan. 19-20.
Weissport,	Lehigh,	Jan. 21-22.

W. H. STOUT, Pinegrove, Schuylkill County, Pa.

Newburg,	Cumberland,	Nov. 29-30.
Middlesex,	Cumberland,	Dec. 1-2.
Shepherdstown,	Cumberland,	Dec. 3-4.
Jonestown,	Lebanon,	Dec. 6-7.
Schaefferstown,	Lebanon,	Dec. 8-9.
Campbelltown,	Lebanon,	Dec. 10.
Deodate,	Dauphin,	Dec. 11.
Pottsville,	Schuylkill,	Feb. 14-15.

MISS SARA PHILLIPS THOMAS, Wayne, R. F. D. No. 1, Delaware County, Pa.

Stewartstown,	York,	Jan. 17-18.
New Freedom,	York,	Jan. 19-20.
Seven Valleys,	York,	Jan. 21-22.
Huffs Church,	Berks,	Feb. 23-24.
Virginsville,	Berks,	Feb. 25-26.

PROF. H. E. VAN NORMAN, State College, Centre County, Pa.

Bloomsburg,	Columbia,	Jan. 10-11.
Allentown,	Lehigh,	Feb. 9-10.

LEON OTICE VAN NOY, Troy, R. F. D. No. 66, Bradford County, Pa.

Bendersville,	Adams,	Jan. 10-11.
Hunterstown,	Adams,	Jan. 12-13.
Fairfield,	Adams,	Jan. 14-15.
Stewartstown,	York,	Jan. 17-18.
New Freedom,	York,	Jan. 19-20.
Seven Valleys,	York,	Jan. 21-22.

MRS. MARY A. WALLACE, Beechwood and Shaw Avenues, Pittsburg, Pa.

Rockwood,	Somerset,	Jan. 3.
Stoyestown,	Somerset,	Jan. 4.
Salix,	Cambria,	Jan. 5-6.
Chest Springs,	Cambria,	Jan. 7-8.
Carrolltown,	Cambria,	Jan. 10-11.
Mechanicsburg,	Indiana,	Jan. 12-13.
Greenville,	Indiana,	Jan. 14-15.
Shelocta,	Indiana,	Jan. 17-18.
Smicksburg,	Indiana,	Jan. 19-20.

D. H. WATTS, Grampian, Clearfield County, Pa.

Will attend all meetings in the Fourth Section from November 29 to February 5.

R. J. WELD, Sugargrove, Warren County, Pa.

Town.	County.	Dates.
New Alexandria,	Westmoreland,	Jan. 3-4.
Madison,	Westmoreland,	Jan. 5-6.
Carnot,	Allegheny,	Jan. 7-8.
Monroeville,	Allegheny,	Jan. 10-11.
Culmerville,	Allegheny,	Jan. 12-13.
New Kensington,	Westmoreland,	Jan. 14-15.

W. THEO. WITTMAN, Allentown, Lehigh County, Pa.

Will attend Movable Schools from December 1 to December 11, and February 9 to February 17, and all meetings in the Fourth Section from December 17 to December 23, and Fifth Section from February 18 to March 8.

WM. H. WOLFF, Elkton, Md.

Will attend all meetings in the Fifth Section from November 29 to December 18.

S. PAUL WOODMAN, Rushland, Bucks County, Pa.

Will attend all meetings in the First Section from November 29 to December 11, and the Fifth Section from February 7 to February 17.

MRS. SARAH B. F. ZEIGLER, Duncannon, Perry County, Pa.

Will attend all meetings in the Third Section from December 3 to December 23.

M. S. BOND was born on a farm in Montour county, Pa., February 26, 1834; lived and worked on a farm until eighteen years old, then taught school seven years, then was employed as a freight and passenger conductor for nine years, and traveled as lost freight and car tracer and purchasing agent for the Delaware, Lackawanna and Western Railroad Company for five years. Has been for over twenty-five years engaged in farming and market gardening; during a part of this time, engaged in breeding and raising blooded Jersey cattle an still keeps some of the best in the State; has made the raising of potatoes by the thousands of bushels a specialty for twenty-five years; has been and is now using more fertilizer to the acre than any man in his county, and is now making gardening a specialty.

JOHN WESLEY BRUCKART was born on his father's farm in West Hempfield township, Lancaster county, Pa. in 1857. Received a common school education and taught school in his native county a number of years. His health failing he farmed the home place and began the raising of pure bred fowls. A dozen years ago he secured a place of thirteen acres adjoining Lititz

borough. Here he has combined the business of market gardening and the growing of pure bred poultry with marked success. The annual income from his thirteen acre farm exceeding the income of the majority of farms ten times as large.

J. T. CAMPBELL was born in Springhill township, Fayette county, Pa., December 18, 1872; is a son of a prominent farmer; received his early education in the public schools of his native district; left the public schools with a more than average education, and at once took up the study of agriculture at home, while working on his father's farm; he studied carefully all leading books and journals of his day. Married in 1894, and took up gardening and poultry culture, and was successful from the start. When the Pennsylvania State College started its Correspondence Courses in Agriculture he took up the work and has since pursued same with diligence. Owns a large farm in Crawford county, upon which he has worked out many important agricultural problems. In poultry culture he has been especially successful, having made it a subject of special study, together with soil physics. Keeps in close touch with the State Experiment Station and the National Department of Agriculture; has written some for various agricultural and poultry journals.

DR. MILTON E. CONARD was born in Southern Chester county in 1851, of an ancestry of sucessful agriculturists. He obtained his education in the Public and High schools and Millersville State Normal School. He was for some years engaged in farming in his home locality; later taking the course in veterinary medicine at the University of Pennsylvania, graduating in 1891, in which institution he has for several years been lecturer of Dairy and Milk Inspection and Veterinary Obstetrics. Throughout his veterinary career he has been closely identified with dairy interests, practising for some years in a dairy locality, and having for over ten years given his entire time as inspector and Consulting Expert for a large number of the dairies furnishing milk to the City of Philadelphia from Pennsylvania, New Jersey, Maryland and Delaware.

M. N. CLARK was born near Export, Westmoreland county, Pa., July 16, 1848; received a good common school education, with several years at an academy and a full course at Duff's Commercial College, at Pittsburg; has always taken an active delight in farming; is a close observer, and for many years has taken an active interest in agricultural affairs of his county; the cause of education has always found in him an earnest supporter; has been engaged in general farming from boyhood, except a few years spent in selling implements; was several seasons in the fruit growing regions of the South, and there gained much information in the use of commercial fertilizers and fruit growing; was a member of the State Board of Agriculture for ten years, and at present is looking after the interest of his farm.

JOHN W. COX was born near New Wilmington, Lawrence county, Pa., December 27, 1868; received a common school education and completed a course at Duff's Commercial College, Pittsburgh; has spent all his life upon the farm; is a breeder of Jersey cattle and Barred Plymouth Rock and Rhode Island Red poultry; wheat, oats, corn, hay and potatoes are his principal crops. He is employed part of the time by the Division of Zoology, Department of Agriculture of Pennsylvania as a Orchard Inspector.

NORMAN BRUCE CRITCHFIELD was born in Somerset county, July 20, 1838; was educated in the public and normal schools of his native county, and at the Ohio University, located at Athens, Ohio; he is by occupation a farmer; during the Civil War he served nine months in the One Hundred and Seventy-first Pennsylvania Militia, and at the close of his term entered the Twenty-eight Pennsylvania Volunteers, with which regiment he continued until the close of the war; he has held in his own county the position of school director, county superintendent of public schools, prothonotary and clerk of courts; elected to the Senate, November 4, 1890; appointed judge in the Department of Agriculture at the World's Columbian Exposition in 1893, and served as vice president and chairman of the board of judges in said department; was re-elected to Senate in 1894, and appointed Secretary of Agriculture, February 24, 1903, and re-appointed by Gov. Stuart, February 25, 1907.

J. D. DETRICH'S knowledge of agriculture, as a science, dates from 1882, since which time has has been availing himself of all the bulletins, magazines and books relating to soil, crops, dairying, breeding and rearing of dairy animals. This together with information furnished by the colleges and experiment stations, he has put into practice, and the result has been a satisfactory and profitable system of extensive farming.

W. M. C. DRAKE was born in Lawrence county, August 16, 1860. He was educated at the public schools and a normal school at New Castle, Pa., passing a teachers' examination. He has spent all of his life on the farm; was president of the Farmers' Alliance in Lawrence county one term. He has been for several years past in partnership with his brother, operating 600 acres of land, besides a market garden and an extensive orchard.

J. A. ESCHBACH was born May 19, 1854, at Fallowfield on the farm he now owns near Milton, Northumberland county, Pa., His education was in the common schools, with a little finishing up at Academy at McEwensville, Pa. Married at twenty-one and has always been engaged in farming, has always taken an active interest in local affairs of his section, serving s school director for thirteen successive years; served as President of Board of Directors of Milton Fair Association; is at present chairman of good roads movement in his own county and member of State Board of Agriculture in same. He has been a success as a farmer and stock-raiser. Breeding-horses, cattle and sheep and hogs, together with raising all the general farm crops raised in his section. He has always taken active interest in Institute work in his county and is at home on all agricultural topics.

F. H. FASSETT, Meshoppen, Pa., was born June 3, 1855, in Windham township, Wyoming county, Pa.; moved to Meshoppen township in 1869 to the farm where he now resides; was educated in the common schools and a course in select schools in Meshoppen borough; has been actively engaged in the growing of tree fruits with marked success for the past 25 years; all up-to-date methods of orchard treatment, spraying and pruning have been in use; took up the business of growing small fruits for the market some 12 years ago and has met with fair success. Is President of Wyoming County Horticultural Society and in close touch with the fruit interest of this section.

WILLIAM FREAR was born in 1860, in Reading, Pa. He was educated in the public schools of that city and of Norristown, entered the preparatory and later the collegiate department of Bucknell University, graduating in 1881; pursued a

post graduate course at Illinois, Wesleyan and Harvard Universities. Spent the growing season of the year during his childhood and youth at work upon a Pennsylvania farm; was made assistant chemist to the United States Department of Agriculture, 1883-5, and was engaged in sugar beet products and cereals. In 1885 he was elected professor of agricultural chemistry in the Pennsylvania State College, and in 1887 was made vice-director and chemist to the Pennsylvania State College Experiment Station. In 1888 he was elected chemist to the Pennsylvania Board of Agriculture, and in 1895 chemist to the Pennsylvania Department of Agriculture. He was also president of National Association of Agricultural Chemists.

H. M. GOODERHAM was born and reared on the farm where he now resides and cultivates in Cambria county, Pa. Was educated in common schools, Academy, Carrolltown, Pa., and Ohio Normal University, Ada, Ohio. After teaching in the common schools for four terms, he took up farming and experimental work which he has followed successfully ever since. He has throughout his life been very much interested in the education and uplifting of his brother farmer and his family. He has held several public offices of trust and is at present Treasurer of Cambria county Horticultural Society and member of the Pennsylvania State Board of Agriculture, holding the distinction of being the youngest member on the Board in the State.

JOHN D. HERR was born on a farm near Millersville, Lancaster county, Pa., in 1870 and spent his boyhood and youth there. In 1886-87 attending Millersville State Normal School, from 1887 to 1891, taught in the public schools of the county, 1891 to 1895, attended Franklin and Marshall College, 1896 to 1898 a student at Columbia University School of Medicine, 1898 to 1905 engaged in commercial pursuits and farming, 1905 to 1909 employed by the State Division of Zoology as Nursery Inspector. Owns and superintends 200 acres of farm lands including 5,000 fruit trees.

JOEL A. HERR was born in Clinton county, Pa., and educated in the public schools and at Dickinson Seminary. He served in the Civil War and has been a student, teacher and farmer all his life. He lives on his farm and gives special attention to fruit culture and stock raising. He is a member of the State Board of Agriculture.

E. S. HOOVER was born in Lancaster county, Pa., in 1839; was educated in the public schools, White Hill Academy and the State Normal School at Millersville, taught school four terms, owns and control a farm. Is engaged in general farming, at one time gave special attention to growing and feeding of live stock, especially in raising and training horses, and, later, devoted himself to the horticultural branch of agriculture, acquiring knowledge of agriculture by study, actual experience and experimenting. Is at present time a member of the board of trustees of Millersville State Normal School; was a member of the Legislature, 1883-1884.

GEORGE E. HULL, the subject of this sketch, a number of years ago moved upon a worn-out farm without buildings in Mercer county. By industry, perserverance and intelligent effort he has succeeded in restoring it to the highest state of fertillity; has placed thereon substantial and convenient farm buildings, and educated his children, without other income than that derived from the farm. His silos, stock scales, farm implements and improved live stock are the admiration of all progressive farmers.

A. J. KAHLER was born in Hughesville, Pa., in 1834; was educated in the public schools and afterwards taught school in his native county; has always lived upon a farm; has filled every local office in his township; was a member of the Legislature in 1891-1892; was president for six years of the County Agricultural Society; is a member of the State Board of Agriculutre and has been identified with most of the leading farm organizations of the State.

KESTER, R. P., was born in Clearfield county, Pa., January 18, 1867. He now resides on the farm which his maternal great grandfather "took-up" and partially cleared nearly 100 years ago. It was farmed for 80 years in the old way and the fertility was depleted until it was one of the worn out" farms. During the past few years Mr. Kester and his younger brother have been farming and dairying by modern methods, until now even five blades of grass grew where one grew before. Their leading business is dairying, although fruit, poultry and trucking receive attention. He was for 15 years a teacher and always a close student and by learning from others and by experiments is making the old homestead farm pay.

J. H. LEDY was born in Marion, Franklin county, Pa., August 3, 1864, and received his education in the common schools of Guilford township and at the Chambersburg Academy. After leaving school he engaged in the mercantile business for seven years at Marion and Waynesboro, Pa. In the spring of 1889 he accepted a position with S. Smucker and Co., wholesale grocers of Philadelphia. He remained with this firm four years, when he was elected register and recorder of Franklin county, after which he became half owner and business manager of the People's Register, of Chambersburg, and independent journal of large circulation. He now owns and superintends 151 acres of apple trees, inlaid with peaches and plums. Mr. Ledy is a practical fruit grower, who loves the work and has turned his whole attention to it.

L. W. LIGHTY was born in York county, Pa., in 1857; attended the public schools of his neighborhood; afterward attended a select school in Adams county and then taught school for seven winters. During this time he attended the York County Academy one term and also attend the State Normal School at Millersville. He then kept store, but not liking the business, he got out of it, and started in the poultry business, keeping both warket and fancy poultry, and engaged in bee-keeping and the culture of small fruits. In 1893 he purchased the farm upon which he now lives. The land was worn out and the buildings quite dilapidated. He has improved this until it is now one of the best farms in his county. He has a large library of standard books, keeps a selected dairy of cows, and has all the modern improvements needed to equip a first-class farm.

THOMAS I. MAIRS spent his early life upon a stock farm and graduated from the College of Agriculture of the University of Missouri in 1896. He took graduate work at the Michigan Agricultural College, the University of Illinois and the University of Missouri. He was Superintendent of Field Experiments at the University of Illinois in 1896-7, and Assistant in Agriculture at the University of Missouri from 1897 to 1901. Since 1901 he has been connected with the Pennsylvania State College, as Assistant Superintendent of Correspondence Courses and Assistant Professor of Animal Husbandry. He has taught Dairy and Animal Husbandry and has had charge of the experimental work along these lines.

M. S. McDOWELL was born in Mifflin county, Pa.; attended the public schools, and Lewistown Academy; entered Pennsylvania State College in 1888, and was graduated in '92; after graduation was connected with a fertilizer manufacturing establishment in Baltimore, and later came to the chemical department of the Experiment Station, with which he has been connected for some years.

A. L. MARTIN was born near Mount Jackson, Lawrence county, Pa., in 1844; received his education in the public schools and at Poland (Ohio) College; served as school director in his native township and that of Little Beaver for eight years; filled the position of census enumerator in 1890; was elected to the House of Representatives in 1892, and served continuously until 1899; was during this continued service a member of the Agricultural Committee, and acted as its chairmain in the session of 1897; by appointment of Governor Pattison, in 1893, became member of Farmers' National Congress and has been reappointed to same position by all subsequent Governors. Was appointed by Governor Stone, April 24, 1899, Deputy Secretary of Agriculture and Director of Farmers' Institutes for Pennsylvania, and reappointed by Governor Pennypacker, April 24, 1903, and also by Governor Stuart, April 24, 1907.

PROF. FRANKLIN MENGES, Ph. D., was born forty-six years ago at Menges' Mill, York county, Pa.; the first nineteen years of his life were spent on his father's farm, with all the ardour that farming meant in those days; he then began a course of preparation for college at the Baugher Academy, Hanover, Pa., and entered and graduated from Pennsylvania College, Gettysburg, with the class of 1886; was immediately tendered and accepted the position of assistant professor of chemistry in his Alma Mater, which position he held until 1896, when he came to York and took the professorship of the sciences in the York High School, which position he now holds; received the degree of Ph. D. from his alma mater for special work in chemistry, mineralogy and physics. He has for years been a student of the "Experiment Station Record," and has continued an interest in practical agriculture, and has lectured before Farmers' Institutes.

HENRY W. NORTHUP was born on a farm in Abington, once considered the banner agricultural township in Luzerne county; he was educated in the public schools and at Madison Academy. His chief business is that of farmer and dairyman; has been greatly benefitted in this line of business for the last ten years by having associated with some of the best and most practical agriculturists in this and adjoining states in the institute work; has had some experience in fruit and market gardening and in disposition of these products in the city of Scranton, where an excellent market has been secured.

PROF. WM. G. OWENS, of Bucknell University, was born in Union county; received his early education in the public schools of Lewisburg, Pittsburg and Allegheny City. Entered Bucknell University 1876; was graduated 1880; took his A. M. in 1883; taught in Bucknell University five years after graduation. In 1885 he became instructor in Natural Sciences. Took special work at Harvard and Berlin, Germany. In 1887 became professor of Chemistry and Physics, the position which he now holds. Has spent almost all his vacations on a farm and thus kept close to nature.

J H. PEACHEY was born in Mifflin county, Pa., in 1851. His boyhood was spent upon a farm; was educated in the public schools and graduated from the Ohio Normal University in 1881. After completing his course at school he followed teaching. In 1887 he began farming for himself and gave attention chiefly to raising hogs, sheep and cattle.

THOMAS J. PHILIPS was born upon a farm in Chester county, Pa., December, 1846; attended public and private schools and graduated from Bucknell University in 1867; spent three years in manufacturing iron, and traveling, and then settled upon the farm where he still lives, giving special attention to dairying and raising

dairy stock, but devoting much of the 200-acre farm to the production of mixed crops, suitable to that location and market. That he had been a success is attested by the fact that he has been a director in a national bank for many years, a manager in one of the largest fire insurance companies in the State, and of a building and loan association; served two terms in the State Legislature, as a representative of the farming interests; he has contributed acceptably from time to time of his experience to the agricultural press, and in every way has kept in the front among the most progressive of his locality, believing in higher education, attractive country homes, and that success is the result of individual effort and judgment.

E. L. PHILLIPS was born on his father's farm in Clarion county, Pa. Was educated in the common schools and a course in the High School at Reid Institute, Pa. Since then he has studied extensively in agriculture. Was married in 1885, after which he devoted his time to agriculture, owning and operating his 200 acre farm with profit to himself. Said farm is in Clarion county, Pa. He has devoted his farm chiefly to the production of fruits, live stock and grain suitable to that location and market. He has been an experimenter with various plant foods. His real estate holdings and commercial standing are a strong recommendation to himself and to the farm.

J P. PILLSBURY was born at Buena Vista, Ohio, in 1873. He was educated in the common schools of that State and the High School of Newark, Ohio. By competitive examination he secured a scholarship in the Missouri Botanical Gardens and Shaw School of Botany, St. Louis, Mo., where he completed a full four years' course of practical and scientific instruction in all branches of Horticulture. After his graduation he became the head gardener of the Pennsylvania State College and Experiment Station and was promoted to Assistant in Horticulture in 1898, which position he still holds. Mr. Pillsbury has had unexcelled opportunities for the study of the practical problems in horticulture and has written several bulletins and reports of his experience with fruits at the Experiment Station.

REV. B. MONROE POSTEN was born in Stroudsburg, Monroe county, Pa., educated in the public schools, and then attended business college in Newark, N. J. Was bookkeeper for Thos. A. Edison and M. Goulds Son and Co., the largest buisiness of its kind in the world. He studied for the ministry, ordained in 1895, and has been in pastorate ever since. Began raising fancy poultry, 1902, winning over 500 premiums at leading shows for excellence. Writes for a number of poultry and farm papers. Is president of borough council and president of board of education in home town. He shipped poultry and eggs to every state and Panama as well as Burma.

R. F. SCHWARZ was born near Berlin, Germany, in 1853; educated in Ducal Gymnasi and Ducal College, at Dessau. He came to New York in 1871, removed to Chicago in 1873, and in 1875 bought a farm in Monroe county, in this State, where he has since followed the business of fruit growing and market gardening, devoting at the present time about thirty acres to this pursuit. He was a member of the House of Representatives two terms, 1893 and 1895.

R. S. SEEDS was born in Huntingdon county, Pa., in 1852; was educated in the public schools and at the Shade Gap Academy. He was raised upon a farm and traveled for eighteen years among the farmers, selling agricultural implements. In 1892 he bought a farm that had been run down, which he has greatly improved.

A. W. STEPHENS was born in Westmoreland county, Pa., and received College training in this State, after which he went to Cornell University and was graduated from there in Agriculture in 1900. For eight years he managed a successful co-operation store and while at Cornell made a special study of co-operation among fruit growers. At present he is an Orchard Instructor for the Division of Zoology.

W. H. STOUT was born October 18, 1840, in Lower Nazareth township, Northampton county, Pa.; was educated in the common schools and engaged in various occupations, serving an apprenticeship at coopering and milling, at clerkship and traveling salesman; has lived on his present farm for the past twenty-eight years, and is engaged in general farming, trucking, fruit growing and bee-keeping; has acquired practical and scientific information by observation and study; speaks English and German.

HARVEY ADAM SURFACE, M. S., Economic Zoologist, was born on a farm in Warren county, Ohio, in 1867. He worked on the farm and attended and taught country school. He was educated in the Lebanon (Ohio) Normal, the Ohio State University, the University of Illinois, Hopkins (Stanford) California Seaside Laboratory and Cornell University. He taught in the Ohio State University, the University of the Pacific, Cornell, the Ithaca schools, teachers' institutes and the Pennsylvania State College. He held a fellowship in Cornell and was also appointed Dykman Research Fellow in Columbia University. He was field naturalist for the Illinois State Biological Station and University Extension lecured in New York. He has also been lecturer in Zoology at the West Coast Chautauqua Assembly and scientific assistant on the United States Fish Commission. He has taught in every known grade of school work, and is noted for his enthusiasm and ability as a teacher, speaker and writer. He is ornithologist of the Pennsylvania State Board of Agriculture, and is making investigations of insects for the Pennsylvania State Department of Agriculture and of fishes for the Pennsylvania State Fish Commission. Among his writing are articles on nature study, zoology, mollusks, insects, fishes, birds, mammals, pedagogy, anatomy, etc. He is nature study editor of the "Popular Educator," ornithological editor of "American Gardening," member of the American Society of Naturalists, American Association for the Advancement of Science, the American Ornithologists, Union, the Pennsylvania State Audobon Society, etc. He makes a specialty of the biologic and economic features of his subjects. He was appointed Economic Zoologist by Governor Pennypacker in 1903, and re-appointed by Governor Stuart in 1907.

PROF. H. E. VAN NORMAN is a native of Ontario, Canada, and is now 36 years of age. He grew up on farms in Nebraska, Illinois and Michigan, and early became acquainted with pure bred livestock through his father's association with a large importer and exhibitor of Holstein sattle and English draft horses, and by attendance at the old Chicago Fat Stock Show. Was appointed Farm Superintendent at Purdue University Agricultural Experiment Station, Lafayette, Ind.; after four years in this work he was appointed Professor of Dairy Husbandry, Pennsylvania State College of Agriculture, which position he now holds.

MRS. MARY A. WALLACE is a daughter of the late Chester W. Ballou, Esq., one of the most successful and progressive of the pioneer farmers of Lawrence county, Pa. She was educated in the public schools and Beaver Seminary, Beaver, Pa., and previous to her marriage taught school in her home district.

Later, to her household duties, she added newspaper work, and became widely known in literature and journalistic circles through her pen name "Aunt Patience," Mrs. Wallace was a charter member of the Pittsburg Women's Press Club and was its treasurer for a number of years. She is also prominent in patriotic societies, and is an honorary member of the One Hundredth Pennsylvania Volunteer (Roundhead) Association. She is in demand as a speaker for Memorial Day.

R. L. WATTS was born at Kerrmoor, Pa., June 5, 1869; raised on the farm of his father, Martin Watts, which farm was largely devoted to fruit culture. Entered Pennsylvania State College in 1887 and graduated from the agricultural course in June, 1890. He was elected assistant instructor in Botany and Horticulture of the University of Tennessee and horticulturist of the Agricultural Experiment Station of this institution in September, 1890. Later he was made Instructor of Horticulture, following by assistant professor of Horticulture and secretary of the Experiment Station. Besides the regular duties as secretary, he has charge of the Farmers' Institutes of the State, held under the auspices of the university and station; he prepared programs, conducted correspondence and participated in the meetings. While at the station he conducts various experiments with fruits and vegetables in the greenhouse and out of doors, the results of which have been published in bulletin form. He wrote Farmers' Bulletin No. 39 on "Onions," for the United States Department of Agriculture. For several years he was editor of the fruit and vegetable department of the "Southern Florist and Gardener;" he is now engaged at the State Colege.

D. H. WATTS was born near Kerrmoor, Pa., May 25, 1861; was raised on the farm of his father, Martin Watts, and educated in the public schools, which schooling was supplemented by a few months attendance at the Indiana State Noraml School. He has always been interester in farmers' organizations and served two years as president of the Clearfield Couny Agricultural Society. He located upon his farm in 1866 and erected thereon modern buildings and established a dairy plant, where fine butter for a special trade is produced. The growing of fruits is also a specialty. On his farm, known as "Orchard View Farm," there are 3,000 apple, peach, pear and plum trees, all his own selection and planting.

W. THEO. WITTMAN, Allentown, Pa., was born and raised on a Lehigh county farm. From boyhood he has been, more particularly, interested in poultry and fruit growing and has made a notable success in both. He is however best known as an expert poultryman, beginning in a small way both as a practical and a fancy poultry breeder, making money at both, nd holds to-day an enviable reputation as an all-round expert chicken man. Being in his element not only as a breeder and judge of the highest grade of poultry, but also well known as an enthusiastic writer and lecturer on his specialty. Being above all intensely practical and never prosy and thus holding a reader or hearer's attention from beginning to end.

WILLIAM HENRY WOLFF, B. S., Agr., was born in St. Georges, Burmuda Island, December 25, 1890. Entered the regular four year course in agriculture at the Pennsylvania State College, September, 1902, and completed the course with degree of B. S. Agr., June, 1906. During the last two years of college work specialized in horticulture. Appointed special field assistant to the Economic Zoologist of Pennsylvania during the summer of 1905, Special Orchard Inspector and Demonstrator for Division of Zoology, Department of Agriculture, Harrisburg, August, 1906 to March, 1907. At present is director of farm at Elkton, Md.

S. PAUL WOODMAN was born on a farm near Rushland, Bucks county, Pa., where he has always lived. He was educated at a common public school, took a three years' course at the George School, near Newtown, Pa. Upon leaving the George School in 1898 he went to work on his father's farm for wages, where he worked until he took entire charge of the farm in 1905. At that time he was taking a correspondence course in agriculture at State College, Pa. He is engaged in general farming, fruit growing and market gardening.

MRS. SARAH BARTRUFF FRITZ ZEIGLER was born near Manheim, Lancaster county. Later moved with her parents to Perry county. Was educated in the public schools, New Bloomfield Academy and Juniata Valley Normal School. Previous to her marriage she taught school six winters. From 1890 to 1902 she manufactured and sold large quantities of jelly to the New York, Philadelphia and Boston markets. Was an active member of Prospect Grange and always held an office in the organization. She has always been deeply interested in agricultural pursuits and since her husband's death has conducted her farm of one hundred and forty (140) acres in an able manner, bringing it up to a high standard of production and adding improvements, believing that pleasant surroundings tend to a better and happier home life.

LIST OF SPECIAL INSTITUTE INSTRUCTORS

Prof. Alva Agee, State College, Pa.
Dr. H. P. Armsby, State College, Pa.
J. S. Burns, Imperial, Pa., R. F. D. No. 1.
Wm. C. Black, Mercer, Pa.
Dr. C. W. Brodhead, Montrose, Pa.
Dr. M. E. Conard, Westgrove, Pa.
Hon. Wm. T. Creasy, Catawissa, Pa.
Dr. J. D. Detrich, No. 438 Adams Ave., Scranton, Pa.
Dr. G. A. Dick, Kane, Pa.
F. C. Foster, Winfield, Pa.
Dr. Carl W. Gay, 36th and Woodland Avenues, Philadelphia, Pa.
H. B. Hilton, Port Allegany, Pa.
Dr. Thomas F. Hunt, State College, Pa.
Horace H. Hall, Ellisburg, Pa., R. F. D.
Dr. Louis A. Klein, Deputy State Veterinarian, Harrisburg, Pa.
Amos B. Lehman, Fayetteville, Pa.
Prof. T. I. Mairs, State College, Pa.
M. S. McDowell, State College, Pa.
Dr. T. E. Munce, Harrisburg, Pa.
M. H. McCallum, Wernersville, Pa.
Prof. J. P. Pillsbury, State College, Pa.
Prof. Wm. G. Owens, Lewisburg, Pa.
Rev. B. Monroe Posten, Sheakleyville, Pa.
T. J. Philips, Atglen, Pa.
Dr. W. H. Ridge, Trevose, Pa.
Prof. J. P. Stewart, State College, Pa.
Prof. H. E. VonNorman, State College, Pa.
Prof. R. L. Watts, State College, Pa.

G. B. Waychoff, Jefferson, Pa.
W. F. Hill, Huntingdon, Pa.
A. Nevin Detrich, Chambersburg, Pa.
Mrs. Jean Kane Foulke, West Chester, Pa.

DEPARTMENT LECTURERS

In so far as time and circumstances will permit, the officers of the Department of Agriculture are desirous of engaging in Institute work.

In order to prevent disappointment in the arrangement of programs, it is recommended that Institute Managers first consult the individual whose services they may wish to secure, before placing his name on the program.

Department lecturers come to these Institutes free of charge, except that they are to be taken from and to the railroad station at the expense of local manager. The topics which they will discuss can be procured by addressing the following officers of the Department of Agriculture:

HON. N. B. CRITCHFIELD, Secretary of Agriculture.
HON. A. L. MARTIN, Deputy Secretary and Director of Institutes.
JAMES FOUST, Dairy and Food Commissioner.
PROF. H. A. SURFACE, Economic Zoologist.
DR. S. H. GILLILAND, State Veterinarian.

AGRICULTURAL SOCIETIES

There has possibly been no year in the history of County Agricultural Societies so marked by the improvement in methods of management. There was greater encouragement given agricultural exhibits by way of increased premiums, employment of expert judges and the engagement of lecturers supplied by this Division of the Department to address the people along the various lines of Farm Operations.

The attendance for 1909 was 1,449,000. Total membership 1910 was 12,055; amount received from State appropriation $28,584.24; amount paid in premiums 1910 was $121,222.00.

List of County and Local Agricultural Societies with Names and Addresses of Presidents and Secretaries and Dates for Holding Fall Exhibitions for 1910, etc.

County	Corporate Name of Society	Name and Address of President	Name and Address of Secretary
	State Horticultural Association of Pennsylvania,	Gabriel Hiester, Harrisburg,	Chester C. Tyson, Floradale.
	Grangers' Inter-state Picnic Association,	R. H. Thomas, Mechanicsburg,	H. S. Mohler, Mechanicsburg.
	Encampment and Fair, Patrons of Husbandry,	Leonard Rhone, Centre Hall,	Leonard Rhone, Centre Hall.
Adams,	The Fruit Growers' Association of Adams County,	Robt. M. Eldon, Aspers,	Edwin C. Tyson, Floradale.
Adams,	Adams County Agricultural Association,	Arthur Roberts, Gettysburg, R. F. D. No. 5.	A. I. Weidner, Arendtsville.
Allegheny,	Allegheny County Agricultural Association,	A. M. Kinney, Imperial,	Chas. H. Stevenson, Coraopolis.
Armstrong,	Dayton Agricultural & Mechanical Association,	Wm. Gallagher, Dayton,	C. C. Cochran, Dayton.
Beaver,	Hookstown Fair Association,	T. C. Glenn, Hookstown,	Allen McDonald, Hookstown.
Bedford,	Bedford County Agricultural Society,	Dr. S. F. Statler, Bedford,	J. Ray Cessna, Bedford.
Berks,	Kutztown Fair Association,	C. D. Herman, Kutztown,	C. J. Rhode, Kutztown.
Berks,	Agricultural and Horticultural Asso. of Berks Co.,	James McGowan, Geiger's Mills,	H. Seidel Thron, Reading.
Blair,	Grange Fair Association of Blair County,	Dr. W. Frank Beck, Altoona,	H. S. Wertz, Duncansville.
Bradford,	Bradford County Agricultural Society,	W. J. McCabl, Towanda,	S. Bergen Park, Towanda.
Bradford,	Troy Agricultural Society,	Liston Bliss, Troy,	D. E. Pomeroy, Troy.
Bradford,	Wyalusing Fair Association,	R. R. Vaughan, Wyalusing,	G. M. Lyon, Wyalusing.
Bucks,	Bucks County Agricultural Society,	Frank W. De Lancey, Sellersville,	I. Y. Barringer, Perkasie.
Butler,	Butler Driving Park and Fair Association,	George A. Schaffner, Butler,	W. B. Purvis, Butler.
Cambria,	Cambria County Agricultural Association,	W. F. Cunningham, Patton, R. F. D. No. 2.	Dr. J. V. Maucher, Carrolltown.
Cameron,	Cameron County Agricultural Association,	F. X. Blumle, Emporium,	Frank D. Judd, Emporium.
Carbon,	Carbon County Industrial Society,	O. F. Acker, Lehighton,	J. Albert Durling, Lehighton.
Centre,	Centre County Agricultural Exhibiting Co.,	John I. Olewine, Bellefonte,	De Laun Stewart, Bellefonte.
Chester,	The Oxford Agricultural Association,	Henry Cope, Lincoln University,	Thos. F. Grier, Oxford.
Chester,	Chester County Agricultural Association,	John H. Darlington, West Chester,	Fred DuRose Reid, West Chester.
Clarion,	Clarion County Fair Association,	B. W. Thompson, Clarion,	S. S. Laughlin, Clarion.
Columbia,	Columbia County Agricultural, Horticultural and Mechanical Association.	Henry Deighmiller, Bloomsburg, R. F. D.	A. N. Yost, Bloomsburg.
Crawford,	Conneaut Lake Agricultural Association,	H. O. Holcomb, Conneaut Lake,	Chas. T. Byers, Conneaut Lake.
Cumberland,	Agricultural Association of Cumberland County,	J. Kirk Bosler, Carlisle,	W. H. McCrea, Carlisle.
Cumberland,	Hogestown Horse and Cattle Show,	J. C. Parker, Mechanicsburg,	J. S. Coble, Mechanicsburg, R. F. D. No. 4.
Dauphin,	Middletown Fair Association,	Colin S. Few, Middletown,	E. Hollis Croll, Middletown.
Dauphin,	Gratz Agricultural and Horticultural Association,	Prof. Harry Smith, Gratz,	F. S. Klinger, Gratz.
Erie,	Corry Fair and Driving Park Association,	J. J. Desmond, Corry,	W. W. Morgaridge, Corry.

List of County and Local Agricultural Societies—Continued.

County	Corporate Name of Society	Name and Address of President	Name and Address of Secretary
Greene,	Greene County Agricultural and Manufacturing Society,	G. M. Bailey, Khedive,	Geo. L. Hathaway, Carmichaels.
Indiana,	Indiana County Agricultural Society,	M. F. Jamison, Indiana,	David Blair, Indiana.
Jefferson,	Jefferson County Agricultural and Driving Park Association,	Samuel Arthurs, Brookville,	Sylvester Truman, Brookville.
Juniata,	Juniata County Agricultural Society,	Charles D. Frankhouse, Port Royal,	James N. Groninger, Port Royal.
Lackawanna,	Lackawanna County Grange Fair Association,	J. A. Yeager, Aberdeen,	Lionel Winship, Moscow.
Lancaster,	Lancaster County Agricultural Fair Association,	P. T. Watt, Lancaster,	I. C. Arnold, Lancaster.
Lawrence,	Pulaski Fair Association,	Geo. Watson, West Middlesex,	H. H. Knox, Pulaski.
Lebanon,	Lebanon Valley Fair Association,	W. H. Bollman, Lebanon,	J. A. Bollmon, Lebanon.
Lebanon,	Lebanon County Agricultural and Horticultural Association.	John H. Bennetch, Newmanstown,	S. P. Heilman, M. D., Heilmandale.
Lehigh,	Lehigh County Agricultural Society,	John W. Eckert, Allentown,	Harry Schall, Allentown.
Lycoming,	Muncy Valley Farmers' Club,	Wm. A. Ball, Hughesville,	Edward E. Frontz, Hughesville.
Mercer,	Mercer Central Agricultural Society,	A. J. McKean, Mercer,	Jno. P. Orr, Mercer.
Mercer,	Mercer County Agricultural Society,	J. H. Williams, Jackson Center,	Chas. B. Hines, Stoneboro.
Monroe,	Monroe County Agricultural Society,	Wm. K. LaBar, Pocono,	H. F. Coolbaugh, Stroudsburg.
Northampton,	Northampton County Agricultural Society,	A. H. Stoffeet, Stockerton,	J. R. Reinheimer, Nazareth.
Northampton,	Pennsylvania State Fair Association,	J. Walter Lovatt, Bethlehem,	H. A. Broman, Bethlehem.
Perry,	Perry County Agricultural Society,	T. H. Butturf, Newport,	J. C. F. Stephens, Newport.
Philadelphia,	Pennsylvania Horticultural Society,	C. B. Newbold, 511 Hort. Hall, Phila.,	David Rust, Hort. Hall, Philadelphia.
Sullivan,	Sullivan County Agricultural Society,	G. E. Bown, Forksville,	O. N. Molyneux, Dushore.
Susquehanna,	Harford Agricultural Society,	Dr. H. H. Hoover, Harford,	H. S. Estabrook, Harford.
Susquehanna,	Susquehanna County Agricultural Society,	N. R. Jones, Montrose,	R. E. Beebe, Montrose.
Tioga,	Cowanesque Valley Agricultural Society,	Frank Strung, Westfield,	J. W. Smith, Westfield.
Tioga,	Smythe Park Association,	T. H. Bailey, Mansfield,	R. C. Longbothum, Mansfield.
Tioga,	Tioga County Pomona Grange,	E. J. Tuttle, Wellsboro, R. F. D. No. 1.	H. Roblyer, Wellsboro, R. F. D. No. 2.
Union,	Union County Agricultural Society,	F. W. Getz, Lewisburg,	C. Dale Wolfe, Bucknell, Pa.
Washington,	Union Agricultural Association,	J. E. Perrin, Independence,	D. S. Taylor, Burgettstown, R. F. D. No. 3.
Warren,	Warren County Farmers and Breeders Association,	J. J. Mahan, Sugargrove.	R. J. Weld, Sugargrove.
Wayne,	Wayne County Agricultural Society,	W. L. Ferguson, Seelyville,	Emerson W. Gammell, Honesdale.
Westmoreland,	Westmoreland Agricultural Society,	M. P. Shoemaker, Greensburg,	W. F. Holtzer, Greensburg.
York,	York County Agricultural Society,	John H. Wogan, York,	Edward Chapin, York.
York,	Hanover Agricultural Society,	C. J. Delone, Hanover,	John B. Miller, Hanover.
York,	Farmers' Improvement Association,	Geo. F. Miller, New Freedom,	W. H. Freed, New Freedom.

List of County and Local Agricultural Societies—Continued.

County	Corporate Name of Society	Attendance, 1909	Race track	Membership		Premiums		Held 1910	
				Number	Aomunt received State fund	Paid, 1909	Offered, 1910	Place	Date
	State Horticultural Association of Pennsylvania.			150					No fair.
	Grangers' Inter-state Picnic Association,	75,000		6				Williams Grove,	Aug. 29-Sep. 3.
	Encampment and Fair, Patrons of Husbandry.	16,000		1,000	105 00	105 00	125 00	Grange Park, Centre Hall.	Sept. 10-16.
Adams	The Fruit Growers' Association of Adams County.			115				Bendersville,	Dec. 14-16.
Adams	Adams County Agricultural Association,								No fair.
Allegheny,	Allegheny County Agricultural Association.		½ mile,	100	100 00	4,500 00		Imperial,	Sept. 20-23.
Armstrong,	Dayton Agricultural and Mechanical Association.	10,000	½ mile,	280	487 57	1,904 25	3,500 00	Dayton,	Sept. 27-30.
Beaver,	Hookstown Fair Association,	6,000	1-3 mile,	9	100 00	700 00	1,000 00	Hookstown,	Aug. 16-18.
Bedford,	Bedford County Agricultural Society,	7,000	½ mile,	400	785 65	785 65	1,000 00	Bedford,	Sept. 20-23.
Berks,	Kutztown Fair Association,	12,000	½ mile,	500	351 21	681 95	2,500 00	Kutztown,	Oct. 4-7.
Berks,	Agricultural and Horticultural Association of Berks County.	70,000	½ mile,	250	648,79	3,000 00	5,000 00	Reading,	Sept. 27-30.
Blair,	Grange Fair Association of Blair County.	50,000	½ mile,	15	100 00	868 50	1,500 00	Hollidaysburg,	Sept. 27-30.
Bradford,	Bradford County Agricultural Society,	17,000	½ mile,	300	700 00	1,700 00	2,200 00	Towanda,	Sept.
Bradford,	Troy Agricultural Society,	10,000	½ mile,	10	209 63	773 70	1,500 00	Troy,	Sept. 13-16.
Bradford,	Wyalusing Fair Association,	5,000		117	107 46	500 00	2,000 00	Wyalusing,	Sept. 6-9.
Bucks,	Bucks County Agricultural Society,							Perkasies,	Sept. 14-17.
Butler,	Butler Driving Park and Fair Association.	7,000	½ mile,	350	610 00	4,147 80	7,000 00	Butler,	Aug. 23-26.
Cambria,	Cambria County Agricultural Association.		½ mile,	378	100 00	575 25		Carrolltown,	Sept. 6-9.
Cameron,	Cameron County Agricultural Association.	5,000			500 00	368 50	500 00	Emporium,	Sept. 13-16.

List of County and Local Agricultural Societies—Continued.

County	Corporate Name of Society	Attendance, 1909	Race track	Membership		Premiums		Held 1910	
				Number	Amount received State fair fund	Paid, 1909	Offered, 1910	Place	Date
Carbon,	Carbon County Industrial Society,	15,000	½ mile,	40	365 00			Lehighton,	Sept. 27-30.
Centre,	Centre County Agricultural Exhibiting Co.	15,000	½ mile,	7	750 00	750 00	1,400 00	Bellefonte,	October.
Chester,	The Oxford Agricultural Association,	20,000	½ mile,		750 00	7,500 00	7,500 00	Oxford,	Sept. 20-23.
Chester,	Chester County Agricultural Association.	18,000	½ mile,	163	500 00	1,573 55		West Chester,	Sept. [illegible]
Clarion,	Clarion County Fair Association,	12,000	½ mile,	250	1,000 00	1,400 00	2,500 00	Clarion,	Sept. [illegible]
Columbia,	Columbia County Agricultural, Horticultural and Mechanical Association.	28,000	½ mile,	296	1,000 00	8,163 15		Bloomsburg,	Oct. 4-8.
Crawford,	Conneaut Lake Agricultural Association.	51,000			1,000 00	5,000 00	7,500 00	Conneaut Lake,	Aug. 29-Sept. 2.
Cumberland,	Agricultural Association of Cumberland County.	15,000	½ mile,	60	1,000 00	1,200 00		Carlisle,	Sept. 27-30.
Cumberland,	Hogestown Horse and Cattle Show,	3,000						Hogestown,	June 15-16.
Dauphin,	Middletown Fair Association,	23,000	½ mile,	87	680 90	992 19	1,800 00	Middleown,	Sept. 13-16.
Dauphin,	Gratz Agricultural and Horticultural Association.	5,000	½ mile,	80	319 00	373 25		Gratz,	Oct. 11-14.
Erie,	Corry Fair and Driving Park Association.	20,000	½ mile,	98	639 74	1,492 90		Corry,	Sept. 13-16.
Greene,	Greene County Agricultural and Manufacturing Society.	7,000	½ mile,	160	707 00	3,800 00		Carmichaels,	Sept. 20-23.
Indiana,	Indiana County Agricultural Society,	40,000	½ mile,		1,000 00	2,150 00	3,000 00	Indiana,	Aug. 30-Sept. 2.
Jefferson,	Jefferson County Agricultural and Driving Park Association.	18,000	½ mile,	40	819 15	819 15	1,000 00	Brookville,	Sept. 13-16.
Juniata,	Juniata County Agricultural Society,	40,000	½ mile,	113	838 00	833 00	1,000 00	Port Royal,	Sept. 13-16.
Lackawanna,	Lackawanna County Grange Fair Association.	6,000		52	216 30	243 30	787 00	Madisonville,	Sept. 20-21.
Lancaster,	Lancaster County Agricultural Fair Association.	75,000	½ mile,	275	424 80	507 56		Lancaster,	Sept. 27-30.

Lawrence,	Pulaski Fair Association,	8,000	½ mile,	100	606 00	1,200 00		Pulaski,	Sept. 12-15.
Lebanon,	Lebanon Valley Fair Association,	15,000	½ mile,	600	987 10	5,650 00	6,000 00	Lebanon,	Aug. 23-26.
Lebanon,	Lebanon County Agricultural and Horticultural Association.								No fair.
Lehigh,	Lehigh County Agricultural Society,	200,000	½ mile,	897	1,000 00	22,300 00	25,000 00	Allentown,	Sept. 20-23.
Lycoming,	Muncy Valley Farmers' Club,	12,000	½ mile,	98	891 85	801 85	1,000 00	Hughesville,	Oct. 11-14.
Mercer,	Mercer Central Society,	20,000	½ mile,					Mercer,	Sept. 5-8.
Mercer,	Mercer County Agricultural Society,				1,000 00	2,800 00	3,000 00	Stoneboro,	Sept. 19-22.
Monroe,	Monroe County Agricultural Society,	50,000	½ mile,		703 65	698 15	1,000 00	Stroudsburg,	Sept. 5-9.
Northampton,	Northampton County Agricultural Society.	7,000	½ mile,	325	546 00	1,844 88	4,000 00	Nazareth,	Sept. 13-16.
Northampton,	Pennsylvania State Fair Association,	65,000	½ mile,		454 00	2,625 00		Bethlehem,	Sept. 6-9.
Perry,	Perry County Agricultural Society,	10,000	½ mile,	324	[illegible]	[illegible]	1,200 00	Newport,	Sept. 20-23.
Philadelphia,	Pennsylvania Horticultural Society,			878		1,870 00	1,910 00	Hort. Hall, Philadelphia.	Nov. 8-11.
Sullivan,	Sullivan County Agricultural Society,	5,000		60	[illegible]	410 00		Forksville,	Oct. 4-7.
Susquehanna,	Harford Agricultural Society,	3,000			[illegible]	[illegible]	1,000 00	Harford,	Sept. 21-22.
Susquehanna,	Susquehanna County Agricultural Society.	4,000		35		600 00		Montrose,	Sept. 13-16.
Tioga,	Cowansque Valley Agricultural Society,	10,000	½ mile,	30	356 85	1,233 92		Westfield,	Sept. 13-16.
Tioga,	Smythe Park Association,	30,000	½ mile,		563 15	3,000 00	3,000 00	Mansfield,	Sept. 20-23.
Tioga,	Tioga County Pomona Grange,		½ mile,	250				Wellsboro,	No fair.
Union,	Union County Agricultural Society,	30,000	½ mile,	202	1,000 00	1,300 00	1,200 00	Lewisburg,	Sept. 27-30.
Washington,	Union Agricultural Association,	2,500	1 mile,	2,000	100 00	4,700 75		Burgettstown,	Sept. 26-29.
Warren,	Warren County Farmers' and Breeders' Association.								No fair.
Wayne,	Wayne County Agricultural Society,	12,000	½ mile,	15	500 00	1,635 70	1,800 00	Honesdale,	Oct. 3-6.
Westmoreland,	Westmoreland Agricultural Society,	15,000	½ mile,	100	1,000 00	4,138 65	5,000 00	Youngwood,	Sept. 6-9.
York,	York County Agricultural Society,	140,000	½ mile,	215	1,000 00	5,072 25	9,000 00	York,	Oct. 3-7.
York,	Hanover Agricultural Society,	15,000	½ mile,			4,233 75	5,500 00	Hanover,	Sept. 20-23.
York,	Farmers' Improvement Association,	12,000		125		50 00		New Freedom,	Sept. 29-Oct. 1.
	Total,	1,449,000		12,055	$28,584 24	$127,061 55	$121,222 00		

CONCLUSION

This report would be incomplete without acknowledging the valuable service rendered the Institute Work by the press of the State both secular and agricultural in publishing dates and places where institutes are held, giving list of speakers, and in fact most of the county papers have published many of the addresses in full, thereby presenting to the farmers who were unable to attend meetings the teachings of the institute. Our County Chairmen of Institutes are growing in efficiency year by year, so that we have today an able Board of Institute Workers in practically every county of the State. The demand for institutes and movable schools of agriculture are increasing year by year, and in like proportion the adoption of methods advocated by our instructors are becoming more general. In order to enforce and encourage better methods in farm pursuits, we should be supplied with a corps of permanent workers whose business it would be to counsel and advise with the farmers of the State relative to soil conditions as adapted to various lines of farming, dairy management, horticulture, poultry and market gardening.

Very respectfully,

A. L. MARTIN,
Director of Institutes.

REPORT OF THE DAIRY AND FOOD COMMISSIONER

Harrisburg, Pa., *December 31, 1910.*

Hon. N. B. Critchfield,

Secretary of Agriculture.

Dear Sir: I have the honor to submit herewith a preliminary report of the Dairy and Food Division of the Department of Agriculture for the year ending December 31, 1910. It covers the operations for the year and contains some details that may be useful for public information.

PRELIMINARY REMARKS

The work of every governmental department which has been some time established includes, of necessity, a large amount of work continuously performed upon the same class of subjects and by methods little changed because of their proven efficiency.

During the year past, this Bureau has continued the examination of food products for sale in the State, for the purpose of determining their conformity to the requirements of the general and special food laws enacted by the Legislature. While the kinds of material examined and the various kinds of abuse in the trade which we have sought to discover are the same as those which have occupied the attention of the Bureau in the years immediately preceding, so that in many of its aspects the work exhibits a strong similarity to that covered in the preceding reports of the Bureau, careful consideration of the facts developed during 1910 will discover many articles newly examined and certain important abuses of recent detection. These will be made the subject of special comment in later paragraphs.

It is a matter of gratification that the public interest in and support of the work of the Bureau have not only been maintained, but have steadily increased. When first enacted, the food laws were received by many intelligent citizens with some doubt as to their wisdom and necessity. The doubt regarding their wisdom grew largely out of the fact that the prime responsibility for sales of adulterated and misbranded foods was placed upon the retailer and it was very generally questioned whether it was either wise or fair to fix the responsibility at this point in the chain of transactions extending from the factory to the hands of the purchaser. The public has, however, come generally to understand that the difficulty of securing adequate proof against the jobbers and manufacturers made it necessary to require

of the retailer the acceptance of the large responsibility imposed by the law, and that he correspondingly take measures to protect himself by increased care in the purchase of the supplies which he selects for distribution to his customers. The public education upon the methods of food manufacture, the nature of the raw material employed therein and the serious character of the frauds which have, in earlier years been perpetrated upon the buying public, has dispelled the doubt as to the necessity of such legislation and has made clear the principle that the man who makes a business of manufacturing on a large scale the foods used to maintain the vigor and health of the people, occupies a position of trust in many respects differing from that held by the housewife who prepares the foods for home consumption.

These changes in the public attitude have appeared, not only among those who are interested solely as consumers, but also among those who are charged with the judicial proceedings under the Acts governing the sale of foods, whether as courts, members of the bar, or jurymen; and, most gratifying of all, the leaders in food production and distribution have come to recognize not only their responsibility, but their full measure of accountability to the public for the manner in which they carry out their part in the important work of feeding the nation. This change in attitude and growth in the sense of responsibility is apparent in the proceedings of nearly all the organizations of food manufacturers and dealers.

The extent of public information upon food subjects at the present day, as compared with that of a decade ago, is almost a matter for surprise. To the discovery and spread of this information many agencies have contributed. Most conspicuous of all these agencies has been the public press, to whose live and aggressive support of all measures looking to the more perfect control of food production and distribution a large degree of admiration is due.

The success of the Bureau's work, must in the end, be judged, not by the number of samples purchased and analyzed, the number of violations of law discovered, or the number of cases prosecuted to a successful issue, important as all these steps are as means to the main end. The true measure of the success of this branch of the State's governmental activities is to be found in the improvement of food commodities sold on the markets, both with respect to their purity and to the truthfulness of labels under which they are sold. As we review the conditions during the year past, we are satisfied that, while there is still great room for improvement in some directions and on the part of some producers and dealers, the condition of the food trade as a whole is one of steady improvement.

The work of every such administrative agency is, if successfully conducted, of an educational character. Many abuses against which the public protests, have had their origin in manufacturing practices

long since established. The demand that such practices be discarded and replaced by unobjectionable processes seems entirely natural and reasonable to the consumer. The producer, on the other hand, naturally sees the facts from another view point; perceives in many cases no satisfactory alternative method for the operation whose previous methods are under condemnation, or realizes that the rejection of older procedure and the adoption of some substitute may involve a very large modification of his factory and a correspondingly great expense to himself. He is at first impelled by self interest to doubt the need for the change urged, to excuse the process by the inadequacy or unproven efficiency of other methods, to plead that he is compelled to present methods by competition, particularly from competitors in localities where the legal requirements are less exacting, and to demand, as the least consideration to which he is entitled, ample time for the discovery and trying out of new methods for the production and packing of the food products condemned. There are facts on both sides of such cases deserving of serious consideration. The Dairy and Food Commissioner is, however, charged by law and obliged by his oath of office to execute and not to make the law. He has faithfully endeavored to warn all parties concerned of the requirements of the law, so that their manufacturing and distributing work might be carried on with the fullest realization of the law's requirements, but he has consistently refused to grant immunities or extensions of time for compliance with the law, where the law has not specifically conferred discretion in such matters upon him.

There is another matter of administrative policy which it may be helpful to mention. The terms of both the general and special food Acts are in many respects broad rather than specific. Wherever the method of the Legislature has been by definition of an offence, such as the adulteration or misbranding of commodities and there has been no definition of the commodity, questions necessarily arise involving the interpretation of the Act as applied to particular commodities, or, in the case of injurious substances, as to what substances should be classed as such, or, even with reference to substances specifically prohibited by name, or as to the meaning of the name and the character of the products included within its scope. It has been the judgment of the Commissioner, after very careful thought, that the prime consideration that should govern his decisions relative to such questions is the spirit and intent of the law. In other words, that it is not the function of the executive officer to give to such Acts their narrowest construction, but that instead, he should take such action as to bring to judicial determination all questions of importance raised by any reasonable construction of the Acts committed to him for execution. For otherwise, instead of serving as the defender of the consumer, he becomes an obstruction to the reaching of a judicial determination

upon such questions. In the statements just made, it is not intended to imply that the Dairy and Food Commissioner does not have a duty to perform toward that part of the public which is engaged in the production and distribution of foods as well as to that part which is interested solely in the buying of such commodities, but merely to express his obligation to bring to judicial determination all questions, relating to food statutes, that are of sufficient importance to require such determination where the evidence obtained by the Bureau's agencies makes possible a satisfactory presentation of the question from the consumer's point of view. It has been the endeavor, however, where questions of this kind have arisen for determination, to bring mooted questions to a decision in such manner as to be fair both to the producer and distributor, on the one hand, and to the consumer, on the other.

THE MONTHLY BULLETIN

The Monthly Bulletin of the Bureau has served during the past year, as during the preceding years, as the means of giving to the public current information concerning the work of the Bureau, and the policy originally adopted by which it was made a medium not only of statements concerning the statistical work of the Bureau, but also of general information on the subject of food production and food control, has been continued.

The demand for these Bulletins and the general interest with which the public has received them have continued in such degree as to prove their value for the purpose stated.

SUMMARY OF WORK FOR THE YEAR 1910

In the Appendix to this report are presented summaries showing the list of articles purchased by the agents and analyzed by the chemists of the Bureau during the year, and also a table giving a list of those classes of articles found adulterated and misbranded and made the basis of prosecutions that have been terminated during the year. The recapitulation of samples analyzed shows a total of nearly 5,600 samples and a sum total of cases terminated of 667. The number of samples analyzed is somewhat less than that reported for the year 1909, but the difference is found chiefly in the number of milk samples taken during the past year. Reasons for this difference will be given in the later paragraph in which the results of the present year's work are considered in detail. The number of instances of misbranding and adulteration found during the past year is about 130 less than in 1909, judging by the lists of cases terminated during these respective years.

A comparison of the number of cases terminated for violation of the laws with the number of samples analyzed, as compared with the corresponding figures for 1909, seems to indicate an increase of adul-

teration. A careful analysis of the statements relative to the several classes of materials indicates that this statistical method of judgment is not entirely warranted. It is believed, on the contrary, that, as has been indicated in the introductory remarks, the conditions of the market show, on the whole, a steady improvement.

In the following portion of this report the several classes of food products examined will be considered separately in detail.

DAIRY PRODUCTS

There have been analyzed during the year 1,777 samples of milk as compared with 2,866 examined in the year 1909.

This year the chemists' findings resulted in prosecutions of which 70 were terminated, while in 1909 the number of similar cases terminated was 126. The greater number of prosecutions this year have been for the skimming of milk sold for whole milk. About half as many prosecutions were instituted for the addition of water and, out of the entire number of samples examined, but 5 cases were discovered in which preservative was added, 4 of them having been found to contain formaldehyde and one a boric acid preservative. The condition of the milk sold in Pennsylvania, considered as a whole, shows a very marked improvement with respect to its adulteration, over the conditions existing until very recently.

The milk Act of 1909 sets no chemical or physical standards for milk. In this respect the law of Pennsylvania differs distinctly from the laws of most states and municipalities controlling the sale of this dairy product. The milk law, as it stands, makes legal the sale of milk without respect to its fat richness or its sanitary condition. The fact is recognized that some unadulterated milk is derived from special strains of dairy cattle that produce large volumes of thin milk and also that individual cows, even of those breeds that commonly yield milk high in solids and fats, occasionally yield, during short periods, milk of a quality far below the normal for the individual and the breed. This law as it stands certainly protects the producer from the remotest possibility of being charged with adulteration by skimming or watering. It may be questioned whether, without serious menace to the producer's true interests, a somewhat higher standard than the poorest product from the poorest cow might not be required for the welfare of the consumer.

In view of the lack of specific chemical or physical standards, conformity to which is readily determined by the methods of analysis long in vogue, it has become necessary in the examination of samples under the present law to have recourse to quit different analytical methods. Fortunately the optical qualities of milk serum, that is, of the liquid portion of milk after the fat and curd have been removed, are practically uniform for the undiluted milk of all the breeds of

cattle, so that by means of a measurement of the optical activity of milk serum by use of the dipping refractometer, it is possible to detect the addition of very small percentages of water. Skimming is detected not only by an abnormally low proportion of fat to the entire milk, but also, and far more definitely, by the proportion which the fat bears to the total solid materials of the milk, the proportion of the fat in the solids of unskimmed milk rarely falling below twenty-seven per cent. of the solids.

By the application of such methods, a large number of cases of skimming and watering have been detected in the present year and have usually been terminated by pleas of guilty on the part of the dealers prosecuted and their payment of the fines and costs imposed.

It is apparent on the most casual consideration of this subject that a thorough and continuous control of the milk produced in the thousands of dairies and sold in the hundreds of communities in this State, is impracticable without the employment of a large force of agents and chemists. It has been the endeavor of the Bureau so to conduct its work that the most effective operation possible with its present force and resources should be secured. The general condition during 1910 as to skimming, watering and the use of preservatives and artificial colors, has been highly satisfactory. In the great majority of communities whose milk supply has been sampled for analysis, few cases of violation of the law, or none, have been discovered. In a few communities, however, very serious conditions appeared, the number of violations of the law being large in proportion to the total number of samples examined. No effect will be spared to protect the milk consumers in such communities.

In relation to milk control, the laws of the Commonwealth have committed to the larger municipalities adequate powers whereby they can organize and maintain agencies for their own protection against milk trade abuses. The Bureau has endeavored to co-operate with these agencies whenever called upon.

CREAM

During 1910, 499 samples of cream were analyzed, of which 27 were found illegal, all but one of them because of a deficiency in butter fat. In 1909, 1,078 samples of cream were analyzed. A number of adverse findings given in the Summary of that year are included in the present list of samples condemned under the milk acts, so that the conditions of the two years under consideration cannot be precisely determined by comparing the figures in the respective Summaries. The facts at command warrant, however, the statement that for this commodity also there has been a distinct improvement in the grade of material offered for sale under the name of "cream."

The Pennsylvania minimum fat requirement for cream is fifteen per cent. The federal standard for this article fixes the minimum at eighteen per cent. and it is this limit controls the interstate sales of cream. In a number of the states of the Union, the laws classify creams into various grades according to richness. The State of Utah, for example, make three grades, in the first of which the fat minimum is thirty per cent., the second twenty-four per cent. and the third eighteen per cent. In view of these facts, the milk dealers in this state should regard the present Pennsylvania standard as sufficiently lenient and should faithfully meet its requirements.

CONDENSED MILK

During 1910 there were examined 16 samples of products sold as condensed milk, evaporated milk and evaporated cream. These examinations resulted in the finding of but one case in which it appeared that condensed skimmed milk had been sold under the name of the corresponding whole milk product.

ICE CREAM

There were examined in 1910, 288 samples of preparations of this class, including a few articles sold under the names "frozen custard", "milk balls", etc. These examinations led to 62 prosecutions for violations of the Act. Three-fourths of the condemnations were due to failure of the ice creams to come up to the fat standards fixed by law. In other cases, the grounds of prosecution were chiefly the addition of artificial coloration, but in a few instances, the addition of sulphurous acid and other ingredients deleterious to health. In 1909, there were examined 227 samples of this class with the discovery of 39 violations of the law, a less proportion than was found during the present year. A careful consideration of all the facts indicates, however, that this increase is only apparent and that the principal volume of the ice cream made in the State by reputable producers conforms well to the present legal requirements. As a result of the experience of preceding years, the examination of ice cream sold by street vendors and by producers of low priced ice creams received particular care, and four-fifths of the prosecutions were for sales made by push cart men, largely of foreign birth, who were selling ice cream cones and similar ice cream preparations to young children.

As a matter of fact, the ice cream law of Pennsylvania is remarkably lenient and any one now guilty of making or selling as ice cream an article that does not meet its requirements, is absolutely without excuse.

It is true that the articles sold for a number of years under the name "ice cream," have exhibited a great variety of composition and this commodity belongs to an important class of cases which deserve

the careful consideration of our legislators to determine whether or not they should be legally classified, so as to distinguish in name and composition between the groups of products now sold under a single name. The very fact that some consumers prefer one kind, and some another, suggests the need for such classification in order that the buyer may get what he expects.

CHEESE

Eleven samples of cheese have been examined during the past year without the discovery of any violation of the cheese law. This condition of affairs, which has continued for a number of years, is highly satisfactory.

BUTTER

During 1910, 938 samples of butter were analyzed, of which but 13 were condemned, the specific findings in four cases being the presence of a foreign fat and excessive amount of water, and, in three cases, that of an excessive amount of water alone.

RENOVATED BUTTER

In recent years the volume of sales of renovated butter in Pennsylvania has been very limited. Only one sample was analyzed, but five cases were successfully terminated for the selling of renovated butter without a license on samples purchased in 1909.

OLEOMARGARINE

Two hundred and eighty-three samples were purchased in 1910 and analyzed by the Bureau chemists. Of these, but 30 were condemned because sold as and for butter. This exhibits an increased compliance with the State law that requires a proper branding of oleomargarine. In addition to these, there were 158 prosecutions for selling colored oleomargarine. The difficulty has earlier been noted of obtaining convictions where the sole ground of indictment was the sale of oleomargarine so made as to resemble yellow butter. The difficulty has not decreased during the present year although the utmost pains have been taken in the production of evidence by the most competent witnesses and in the marshalling of evidence by the Bureau's attorneys; a large fraction of the cases brought to a successful termination were those in which proof was produced that the color was due to the introduction of artificial dye stuffs. The serious point of difficulty in securing convictions has been in those cases where the resemblance to yellow butter was, so far as the facts could be demonstrated, due to the selection of high colored fats and to the more or less abundant use of butter as an ingredient in the article. While the volume of oleomargarine sales has, under the present condition of

prices for food products, shown a marked increase, it is worthy of note that the sale of white oleomargarine is greater today than it has been at any time since the present oleomargarine act was passed.

There seems to be an impression on the part of a portion of the public that the laws of the State are intended to prohibit the sale of oleomargarine, whereas the contrary is the fact. The law recognizes that oleomargarine properly made and kept free from such appearance as tends to confuse it with normal butter, is a wholesome and unobjectionable food. The law does, however, prescribe for the protection of the consumer certain requirements,—that the sale shall be properly licensed, that the article shall be kept free from resemblance to yellow butter, and that the packages shall be properly stamped with the true trade name of the product. It is the violation of these regulative requirements that has led to the large number of prosecutions for illegal sales of this product. The law is clear and not only makes it an offence to sell oleomargarine as and for butter, but also to make and sell at all oleomargarine resembling yellow butter, no matter how wholesome such product may be.

MEAT PRODUCTS

During 1910, there were examined 257 samples of meats and fish, canned and fresh, including sausages. With respect to all but the latter meat product, the examination revealed no adulteration. About 17 samples of sausages and 3 of minced ham were, however, found adulterated, in most instances by the addition of starch and water and in one case by the use of a sulphite preservative. The great difference in the price of starch and water on the one hand and of meat on the other, makes it extremely desirable, for the protection of the buying public, that the needless use of starch and the unlimited addition of water should be stopped.

LARD

There were examined during the past year 20 samples and there were five cases successfully terminated because of adulteration with foreign fats. The operation of the lard act has resulted in a very marked improvement of the trade in this commodity.

EGGS

Thirty-seven samples of eggs have been examined during the present year. The list of cases terminated for violation of the egg act was 44, of which a considerable number represented samples examined during 1909. Public sentiment has vigorously supported this law and the position taken by the courts has been strongly conducive to a careful regard for the law's provisions. It is recognized that, with all reasonable care, under existing conditions of production, there

will be the unwitting collection and sale of some eggs that are unfit. Due care has, however, been taken that prosecutions should be instituted only in such cases as exhibit a large proportion of spoiled eggs in the consignment examined.

FRUIT AND VEGETABLE PRODUCTS, CANNED FRUITS AND VEGETABLES

Two hundred and fifteen samples of canned fruits and vegetables and 7 of canned soups have been examined during 1910 without the discovery of any violations of the law. Upon this remarkable showing the packers of canned goods are to be congratulated, both for their spirit of faithful observance of the law's requirements and for their recognition of the business wisdom of so doing.

CATSUPS, ETC

Of catsups, chowchow, oils and salad dressings 129 samples were examined and 19 prosecutions successfully terminated for violations of the law. The prosecutions were limited to tomato catsups, and the chief ground for prosecution was the excessive use of benzoate of soda. There was but one case in which an article sold as olive oil was found to contain cotton seed oil. This formerly prevalent form of adulteration has been almost entirely suppressed.

It may be added in this connection that there were, of the prosecutions terminated during the year, 123 cases in which adulteration of pickles was claimed, in most cases owing to the evidence of the presence of alum. The precise determination of the aluminium compound used in hardening pickles is a matter of very great difficulty. In the food act of May 13, 1909, the addition of alum is prohibited. In the case of the Commonwealth vs. Meyer Gross, tried in Dauphin county, the construction of this word as used in the act was presented for judicial determination and the arguments for its broad and narrow constructions were ably presented by both sides to the controversy. In his decision, Judge Allison O. Smith, specially presiding, handed down an opinion to the effect that the word alum, as used in the act of May 13, 1909, means only potash alum and not the sodium aluminium compound designated in the wholesale trade as "S. A. S.", which is commonly used in what are called "alum baking powders," nor other closely related aluminium sulphate salts often known, whether in scientific or technical writings, as "alum".

In view of the evidence and decision just referred to, the special counsel for the Commonwealth, Hon. Lyman D. Gilbert, A. H. Woodward, Esq., and Hon. E. E. Beidleman, have advised the Commissioner that it cannot be successfully contended that the substance "S. A. S." is alum in the statutory meaning of that word. In view of the analytical difficulties of determining, upon examination of the product, the precise nature of the compound in which the alumina and sulphuric

acid found in pickles, were introduced, it is deemed impracticable to bring to a successful termination prosecutions based upon evidence now obtainable of the introduction of alum into pickles, for in the case of pickles, even though all the constituents that unite to form potash alum be discovered by the chemist, it is impossible, since potash is always present in the vegetable, and varies in the proportion present therein, to prove that the potash found was introduced into the pickles in association with the alumina and the sulphuric acid in the form of potash alum.

FRUIT BUTTERS, JAMS, JELLIES, PRESERVES

Of this important class of products, 74 were examined during 1910 without the discovery of any violations of the act. In the list of prosecutions terminated, there appear two cases instituted because of the use of sulphurous acid in the preparation of dried peaches. These prosecutions were instituted under the Act of 1907, but failed of successful termination for the reason that the Act was declared unconstitutional and later repealed by the Act of 1909.

In the same connection, may be mentioned the examination of five samples of fruit syrups of which number three were found to be adulterated and prosecutions successfully terminated for violations of the law.

VINEGAR

There were examined in 1910, 25 samples of vinegar, most of which were sold as cider vinegar, and six cases were successfully prosecuted for adulteration. There is still on sale a considerable volume of spurious vinegar sold as if derived from pure apple juice. The variety of adulteration that has arisen in this manufacture shows a resourcefulness that would be admirable in a better cause. The difficulty of the enforcement of the law has been increased in this class of cases by the expectation on the part of the public that the evidence should not only prove conclusively that the article is not what it claims to be, but also that it should suffice to establish what the article really is. It is fair to ask why more should be expected in the way of proof than the presentation of conclusive evidence that the article does not correspond to the name under which it was sold.

BAKERY PRODUCTS

There were analyzed in connection with the work of the year, 122 samples of biscuit, cakes, pies and puddings. The examination revealed very few instances of adulteration, but those which were discovered were of peculiar interest. Seven samples of "frou frou wafers", an imported product, were found to contain a boric acid preservative. A number of samples of ice cream cones were examined,

owing to the discovery elsewhere of adulteration by the use of saccharin instead of sugar, and the introduction of boric acid, probably in the eggs used as an ingredient. One or two cases were found in which boric acid was present, but in general these products were found free from the adulterations mentioned.

In the case of cakes, 15 cases were terminated in which the ground of indictment was the presence of coal tar dye as a coloring matter. One pie filler was found adulterated in a similar manner.

A thickener used in the preparation of ice cream, whipped cream, etc., was composed in part of a product prepared from soap bark and containing detectible quantities of the poisonous substance, saponin.

In this connection may be mentioned the examination of 20 samples of corn starch, buckwheat and wheat flours, baking soda and baking powder. The flours were not found adulterated. The baking powders, belonging to the class commonly known as alum powders, under the findings in the case of the Commonwealth vs. Meyer Gross already referred to, have by the decision of the court been taken out of the class of goods prohibited by the act, as a sodium aluminium compound is commonly used in the preparation of such baking powders.

CANDY

Three hundred and thirty-six samples of candy were examined during the year. Very few instances of adulteration were discovered and but five cases of violations of the law were terminated, although several are now pending.

FLAVORING EXTRACTS

Forty samples of materials sold as flavoring extracts, essences, or flavorings, were examined during the year and three cases successfully terminated for violations of the act. These findings show a very distinct improvement both in the quality of the articles now offered as flavoring extracts and also in the truthfulness of the labels under which they are sold.

NON-ALCOHOLIC DRINKS

During 1910 there were examined 278 samples of non-alcoholic drinks and 68 cases were successfully terminated, a portion of which were based upon findings made in 1909. This class of products has been wonderfully improved and the manufacturers of these beverages have shown a most laudable disposition to comply strictly with the requirements of the law except in the two large cities Everywhere else the use of saccharin, formerly almost universally used as a substitute for sugar, has been abandoned. Among the cases of special interest in this connection may be mentioned those in which capsicum (red pepper) was used to add to the pungency of ginger ales. The Bureau

insists that this adulteration shall be stopped and the sale of such preparations shall be discontinued unless the presence of the added pungent substance be declared upon the labels.

MISCELLANEOUS PRODUCTS

Of the 161 materials, of a great variety were examined. Deserving of especial mention are those of maple syrup (28 samples with the discovery of but one case of misbranding); and nuts, of which, in a good many instances, a large proportion of those purchased were wormy or decomposed. From the presentation of the evidence, the action of the Department in instituting prosecutions for such violations of the act, was clearly sustained.

FINANCIAL STATEMENT

A classified statement of the receipts and expenditures of the Bureau for the year 1910 is presented in the Appendix, showing total receipts to the amount of $110,802.95 and a total expenditure of $79,661.65. Of the receipts, over $79,000 were from oleomargarine license fees; over $15,000 from fines imposed for the violation of the oleomargarine law.

The statement shows that the receipts, all of which have been turned into the State Treasury for the use of the Commonwealth, have been considerably more than the entire cost of maintaining the Bureau during that time.

CONCLUSION

In the performance of the large volume of work described in the foregoing paragraphs, the Commissioner has been greatly indebted for encouragement and advice given by the Governor of the Commonwealth, Hon. Edwin S. Stuart, and the Secretary of Agriculture, Hon. N. B. Critchfield. He desires to acknowledge also the hearty co-operation given to him by the Attorney General's Department, and to express his appreciation of the efficient and loyal assistance of the special agents, the chemists, special counsel and office force of the Bureau.

JAMES FOUST,

Dairy and Food Commissioner.

APPENDIX

SUMMARY

The following gives a list of articles analyzed by Chemists of this Bureau during the year 1910.

Article.	Number Analyzed.
DAIRY PRODUCTS:	
Butter,	938
Cheese,	11
Cream,	499
Milk,	1,777
Milk, skimmed,	47
Milk, butter,	8
Milk, condensed,	7
Milk, evaporated,	7
Cream, evaporated,	2
	3,296
OLEOMARGARINE,	283
RENOVATED BUTTER,	1
EGGS, (Dried and in the shell),	37
BAKING POWDER, BAKING SODA, CORNSTARCH AND FLOUR:	
Baking powder,	10
Baking soda,	1
Cornstarch,	3
Flour, buckwheat,	5
Flour, wheat,	1
	20
BISCUITS, CAKES, PIES AND PUDDINGS:	
Biscuit, Fabrick,	3
Biscuit, Frou Frou,	16
Biscuit, Snowflake,	1
Biscuit, Uneeda,	1
Cake, Candy Pound,	1
Cake, Chocolate Lady Fingers,	1
Cake, Fig,	1
Cake, Jelly,	1
Cake, Marble,	1
Cake, Marshmallow Ginger,	1
Cake, Marshmallow Pound,	1
Cake, Marshmallow Sponge,	1
Cake (no name given),	5
Cake, Pound,	3
Cake, small,	2
Cake, Sponge,	7
Cream Puffs,	1
Foamoline,	2
Gelatine,	2
Jello,	2
Nabiscos,	2
Pie, Apple,	15
Pie, Apricot,	2
Pie, Berry (no name given),	6
Pie, Blackberry,	1
Pie, Cherry,	1
Pie, Cocoanut Custard,	4
Pie, Egg Custard,	6
Pie, Huckleberry,	3
Pie, Lemon,	10
Pie, Lemon Custard,	1
Pie, Lemon Meringue,	1
Pie, Peach,	9
Pie, Raisin,	5
Pie Filler (Lemon),	2
Tapioca,	1
	122

SUMMARY—Continued.

Article.	Number Analyzed.
CANDY:	
Candy Apples,	1
Candy Balls,	1
Candy Bananas,	1
Candy, Chocolate,	97
Candy, Chocolate Coated Almonds,	11
Candy, Chocolate Bars,	9
Candy, Chocolate Buds,	1
Candy, Chocolate Caramels,	3
Candy, Chocolate Coated Cocoanut,	1
Candy, Chocolate Coated Cross,	1
Candy, Chocolate Creams,	8
Candy, Chocolate Drops,	30
Candy, Chocolate Eggs,	2
Candy, Chocolate Coated Filberts,	1
Candy, Chocolate Kisses,	13
Candy, Chocolate Maple,	1
Candy, Chocolate Maraschino Cherries,	1
Candy, Chocolate Mint Drops,	3
Candy, Chocolate Orange Creams,	1
Candy, Chocolate Coated Peanuts,	8
Candy, Chocolate Slabs,	3
Candy, Chocolate Wafers,	17
Candy, Cocoanut Eggs,	1
Candy, Easter Eggs,	1
Candy Eggs, Green,	1
Candy Eggs, Pink,	2
Candy Eggs, White,	1
Candy Figs,	1
Candy, French Nougets	1
Candy Fruit Eggs,	1
Candy, Fudge, White,	1
Candy, Gum Drops,	4
Candy Gum, Spiced,	1
Candy Lemon,	1
Candy, Marshmallows,	42
Candy, Marshmallow Bananas,	1
Candy, Marshmallow Bars,	1
Candy, Marshmallow Blocks, Chocolate coated,	3
Candy, Marshmallow Cocoanuts,	2
Candy, Marshmallow Clams,	1
Candy, Marshmallow Cream Squares,	1
Candy, Marshmallow Dainties,	1
Candy, Marshmallow Drops,	1
Candy, Marshmallow Drops, Chocolate coated,	2
Candy, Marshmallow Eclairs,	1
Candy, Marshmallow, "Exposition Bars,"	1
Candy, Marshmallow Gems,	1
Candy, Marshmallow Lemons,	2
Candy, Marshmallow Oysters,	1
Candy, Marshmallow Porkers, Chocolate coated,	1
Candy, Marshmallow Pumpkins,	1
Candy, Marshmallow, Vanilla,	2
Candy, Mixed,	2
Candy (no name given),	31
Candy Orange,	1
Candy, Peanut Brittle,	1
Candy, Peppermint,	2
Candy Rabbit,	1
Candy Relishes,	1
Candy, Violet,	1
Candy, Whipped Caramel Drops,	1
	336

CANNED FRUITS AND VEGETABLES:	
Apricots,	1
Asparagus,	2
Beans, baked,	4
Beans, string,	8
Blackberries,	1
Cherries,	11
Cherries, Creme de Menthe,	1
Cherries, Maraschino,	15
Corn,	27

SUMMARY—Continued.

Article.	Number Analyzed.
CANNED FRUITS AND VEGETABLES—Continued.	
Figs,	1
Gherkins, sour,	7
Gherkins, sweet,	9
Mincemeat,	13
Mushrooms,	15
Olives,	7
Parsnips,	1
Peaches,	2
Peas,	36
Pickles, cucumber,	18
Pickles, mixed,	5
Pickles, spiced,	6
Pie Fruit (cherry flavor),	1
Pineapple,	5
Plums,	3
Sauer Kraut,	2
Strawberries,	1
Succotash,	2
Tomatoes,	11
	215
CATSUPS, OILS, SALAD DRESSING, SAUCES, ETC.:	
Catsup (no name given),	11
Catsup, Tomato,	60
Catsup, Walnut,	1
Chow Chow,	1
Horseradish,	4
Oil, cooking,	20
Oil, Olive,	19
Oil, Palm,	1
Oil, Peanut,	1
Oil, Salad,	6
Salad Dressing,	1
Sauce, Bohemian,	1
Sauce, Challenge,	1
Sauce, Chilli,	2
	129
FRUIT BUTTERS, JAMS, JELLIES AND PRESERVES:	
Butter, Apple,	3
Butter, Peanut,	5
Jam (no name given),	4
Jam, Plum,	1
Jam, Plum and Apple,	1
Jam, Quince,	3
Jam, Raspberry,	1
Jam, Strawberry,	2
Jam, Strawberry and Apple,	1
Jelly, Apple,	15
Jelly, Apple and Currant,	2
Jelly, Apple and Pineapple,	2
Jelly, Crabapple,	6
Jelly, Currant,	4
Jelly (no name given),	4
Jelly, Quince,	1
Jelly, Strawberry,	1
Jelly, Wine,	1
Preserves, Blackberry,	1
Preserves, Cherry	2
Preserves, Damson,	1
Preserves, Lingon,	1
Preserves (no name given),	3
Preserves, Pineapple,	1
Preserves, Plum,	1
Preserves, Raspberry,	2
Preserves, Strawberry,	4
Preserves, Tomato,	1
	74

SUMMARY—Continued.

Article.	Number Analyzed.
FLAVORINGS, ESSENCES AND EXTRACTS:	
Flavoring, Lemon,	1
Essence, Lemon,	2
Extract, Almond,	1
Extract, Banana,	1
Extract, Lemon,	14
Extract, Orange,	1
Extract, Peach,	1
Extract, Raspberry,	1
Extract, Strawberry,	5
Extract, Vanilla,	13
	40
FRUIT SYRUPS:	
Cherry,	1
Strawberry,	4
	5
ICE CREAMS:	
Ice Cream, Caramel,	2
Ice Cream, Cherry,	1
Ice Cream, Chocolate,	26
Ice Cream, Maple,	2
Ice Cream, Marshmallow,	1
Ice Cream (no flavor given),	27
Ice Cream, Orange,	1
Ice Cream, Peach,	12
Ice Cream, Pineapple,	3
Ice Cream, Strawberry,	49
Ice Cream, Tutti Fruitti,	1
Ice Cream, Vanilla,	150
Ice Cream, Walnut,	3
Frozen Custard,	3
Lemon Ice,	1
Milk Balls,	5
Strawberry Klondike Frost,	1
	288
LARD,	20
MEATS AND FISH—CANNED AND FRESH:	
Bacon, Fresh,	2
Bacon and Beans,	1
Beef, Corned,	2
Beef, Chipped, Dried,	8
Beef, Sliced,	4
Beef, Sliced and Smoked,	1
Beef, Stewing,	1
Bologna,	25
Bologna, Beef,	5
Bologna, Ham,	2
Chicken, Boneless,	1
Chicken, Fresh,	1
Chops (no name given),	1
Clams,	1
Codfish,	4
Codfish, Dried,	1
Codfish, Shredded,	5
Deviled Crabs,	1
Fish Flakes,	1
Fish Roe,	1
Frankfurters,	13
Ham,	2
Ham, Minced,	4
Ham, Potted,	1
Ham, Pressed,	2
Hamburger Steak, fresh,	13
Herring, Boneless,	1
Herring, fresh,	1
Liverwurst,	2
Liver Blood Sausage,	1
Lobster, canned,	2
Lobster Flake,	1
Mackerel, Salt,	1
Oysters, canned,	10
Oysters, fresh,	3

SUMMARY—Continued.

Article.	Number Analyzed.
MEATS AND FISH—CANNED AND FRESH—Continued.	
Pork and Beans,	5
Potted Meats (ham flavor),	3
Round Steak, fresh,	1
Salmon, canned,	9
Salmon, fresh,	1
Sardines,	4
Sausage, fresh,	26
Sausage, fresh pork,	19
Sausage, Polish,	1
Sausage, smoked,	4
Sausage, half-smoked,	2
Sausage, Vienna,	1
Sausage, Wiener,	52
Shrimps,	2
Soup bone,	1
Tongue,	1
	257
NON-ALCOHOLIC DRINKS:	
Bittermead Beverage,	1
Birch Beer,	22
Cherry Punch,	1
Cherry Smash,	4
Cider, Sweet,	1
Cola Coke,	1
Coca Cola,	3
Ginger Ale,	25
Grape Juice,	15
Grapemist,	1
Jersey Creme,	3
Lemonade,	3
Lemon Sour,	5
Liquid Force,	2
Mineral Water,	1
Moxie,	1
Noxem-All,	1
Orangeade,	3
Pepsicola,	1
Phosphate, Cherry,	2
Phosphate, Orange,	1
Pop, Birch,	1
Pop, Blackberry,	1
Pop, Cream,	1
Pop, Dark,	1
Pop, Lemon,	4
Pop (no name given),	1
Pop, Orange,	1
Pop, Peach,	1
Pop, Raspberry,	1
Pop, Strawberry,	13
Pop, Vanilla,	2
Pop, White,	1
Red Colwa,	1
Root Beer,	6
Strawberry, artificial,	2
Sarsaparilla,	11
Soda, Cherry,	1
Soda, Chocolate,	3
Soda, Cream,	13
Soda, Lemon,	10
Soda (no name given),	74
Soda, Orange,	4
Soda, Pineapple,	2
Soda, Raspberry,	2
Soda, Strawberry,	20
Soda, Vanilla,	1
Soda, Vanilla and Tonka,	1
	278
SOUPS:	
Soup, Chicken,	3
Soup, Condensed Bouillon,	1
Soup, Tomato,	2
Soup, Vegetable,	1
	7

SUMMARY—Continued.

Article.	Number Analyzed.
VINEGAR:	
Vinegar, Cider,	23
Vinegar, Red,	2
	25
MISCELLANEOUS PRODUCTS:	
Almonds,	1
"Beat It,"	1
Blush Rose Color,	1
Celery Tonic,	1
Cordial, Cherry,	1
Cordials (no name given),	5
Chestnuts,	7
Chocolate,	3
Cocoa,	8
Cocoanut, Shredded,	1
Color for Strawberry Ice Cream,	1
Cones for Ice Cream,	29
Cracker Meal,	1
Cream Powder,	1
Cream Nuts,	6
Cough Drops,	1
Fig Bars,	1
Fig Paste,	1
Frosted Oranges,	1
Frozen Dainties,	1
Glucose,	1
Grape Fruit,	1
Honey,	9
Ice Cream Filler,	2
Jelly Sugar Dessert,	1
Lemons,	1
"Make Cream,"	1
Maple Sugar,	3
Meat Preservative,	1
Mixed Nuts,	5
Mustard, German,	1
Mustard, prepared,	3
"Napoleons,"	1
Oranges,	1
Peanuts, burnt,	1
Pecans, Maraschino,	1
Pickled Pigs Feet,	1
Pickled Tripe,	1
Pigs Feet Jelly,	1
"Sorbetto,"	1
Sugar Butter Mixture,	1
Sugar Wafers,	1
Syrup, Corn,	2
Syrup, Maple,	28
Syrup, Table,	1
Walnuts, English,	16
Whipped Cream,	1
Whip E. Z.,	2
	161

RECAPITULATION.

Butter,	938
Cheese,	11
Cream,	499
Milk,	1,848
Oleomargarine,	283
Renovated Butter,	1
Eggs,	37
Fruit Syrups,	5
Ice Cream,	288
Lard,	20
Non-Alcoholic Drinks,	278
Vinegar,	25
Food,	1,861
Total,	5,594

FINANCIAL STATEMENT

RECEIPTS AND EXPENDITURES OF THE DAIRY AND FOOD BUREAU FOR THE YEAR 1910

RECEIPTS

Oleomargarine license fees,	$79,697 11
Oleomargarine fines,	15,456 92
Pure food fines, act of 1909,	6,626 88
Egg fines,	3,105 00
Milk fines, act of 1909,	1,627 98
Ice cream fines,	1,476 06
Non-alcoholic drink fines,	1,237 50
Renovated butter license fees,	700 00
Vinegar fines,	248 50
Lard fines,	200 00
Milk fines, act of 1901,	157 50
Meat fines,	100 00
Renovated butter fines,	97 00
Pure food fines, act of 1907,	72 50
	$110,802 95

EXPENDITURES

Special agents' salaries,	$20,592 00
Traveling and agents' expenses,	17,865 91
Chemists and laboratory,	16,958 35
Attorneys, detectives and assistants,	15,816 39
Clerical and stenographers,	8,429 00
	$79,661 65

All the receipts of the Bureau are paid into the State Treasury for the use of the Commonwealth and the Bureau is maintained by an appropriation made by the Legislature.

CASES TERMINATED

THE FOLLOWING TABLE GIVES A LIST OF ARTICLES ANALYZED BY CHEMISTS AND FOUND TO BE IN VIOLATION OF THE FOOD LAWS, THE NUMBER OF SAMPLES OF EACH PRODUCT ON WHICH PROSECUTIONS WERE BASED AND TERMINATED, AND THE TOTAL AMOUNT OF FINES AND COSTS ACCRUING.

Number of samples.	Article	Fines and costs.
1	"Beat It," containing saponin,	$60 00
1	Birch Beer, adulterated and containing saccharin,	25 00
1	Biscuit Fabrick, containing boric acid,	60 00
2	Bologna, containing added starch,	120 00
1	Bologna, Polish, adulterated,	60 00
6	Butter, adulterated,	60 00
3	Butter, containing an excessive amount of water,	125 00
4	Butter, containing a foreign fat and an excessive amount of water,	120 00
2	Buttermilk, artificially colored,	60 00
1	Cake, artificially colored,	60 00
14	Cake, containing coal tar color,	312 50
2	Catsup, adulterated,	120 00
2	Cherry Smash, misbranded,	25 00
1	Cherry Phosphate, misbranded,	25 00
1	Chestnuts, unfit for food,	60 00
1	Condensed Skimmed Milk, as milk,	20 00
1	Cones, colored and sweetened with saccharin,	60 00
2	Cooking Oil, colored with annatto,	120 00
4	Cooking Oil, colored with coal tar dye,	240 00
1	Cornstarch, adulterated,	00 00
1	Cream, adulterated,	20 00
26	Cream, below standard for butter fat,	405 00
5	Cucumber Pickles, adulterated,	322 56
4	Eggs, unfit for food (under Act of 1907),	72 50
40	Eggs, unfit for food (under Act of 1909),	3,105 00
1	"Exposition Bars" (candy marshmallows) containing sulphurous acid,	60 00
2	Frankfurters, adulterated,	120 00
1	French Peas, containing compounds of copper,	60 00
4	Frou Frou, adulterated,	120 00
2	Frou Frou, containing borates,	120 00
1	Frou Frou Wafers, containing boric acid,	60 00
1	Frozen Custard, containing coal tar dye,	25 00
3	Fruit Syrup, adulterated,	00 00
1	Gelatine, containing sulphurous acid,	60 00
1	Gherkins, Sweet, adulterated,	60 00
4	Ginger Ale, containing capsicum,	75 00
1	Grape Juice, watered,	25 00
1	Grape Nuts, misbranded,	00 00
4	Ice Cream, adulterated,	101 06
5	Ice Cream, artificially colored,	125 00
28	Ice Cream, below standard for butter fat,	650 00
2	Ice Cream, below standard for butter fat and artificially colored,	50 00
1	Ice Cream, containing ingredient deleterious to health,	60 00
5	Ice Cream, containing sulphurous acid,	125 00
1	Ice Cream, misbranded,	60 00
2	Ice Cream, Chocolate, low in fat,	50 00
2	Ice Cream, Chocolate and Vanilla, low in fat,	25 00
1	Ice Cream, Peach, artificially colored,	25 00
1	Ice Cream, Strawberry, colored and low in fat,	25 00
9	Ice Cream, Vanilla, below standard for butter fat,	225 00
1	Ice Cream Cones, low in fat,	25 00
1	Ice Cream Filler, containing saponin,	60 00
2	Lard, adulterated,	100 00
1	Lard, Compound, containing less than 50 per cent. lard,	50 00
1	Lard, containing beef stearin,	00 00
1	Lard, containing cotton seed product and beef fat,	50 00

CASES TERMINATED—Continued.

Number of samples.	Article	Fines and costs.
1	Lemon Extract, misbranded,	60 00
1	Lemon Syrup, misbranded,	60 00
1	Maple Syrup, misbranded,	60 00
3	Maraschino Cherries, adulterated,	180 00
1	Maraschino Cherries, containing sulphurous acid,	60 00
4	Marshmallows, containing sulphurous acid,	180 00
1	Milk, adulterated,	20 00
1	Milk, artificially colored,	60 00
21	Milk, containing added water,	438 98
1	Milk, containing boric acid,	50 00
4	Milk, containing formaldehyde,	107 50
17	Milk, low in butter fat,	242 50
24	Milk, skimmed, as and for whole milk,	481 50
3	Minced Ham, containing added starch,	188 02
24	Oleomargarine, as and for butter,	1,696 00
106	Oleomargarine, colored,	7,521 20
3	Oleomargarine, colored, sold as and for butter,	300 00
29	Oleomargarine, colored, and selling without a license,	1,510 84
6	Oleomargarine, colored, sold as and for butter and without a license,	600 00
4	Oleomargarine, colored, and not stamped,	291 00
45	Oleomargarine, selling without a license,	2,524 06
1	Oleomargarine, selling without a license and peddling,	100 00
1	Oleomargarine, selling at wholesale without license,	19 46
1	Oleomargarine, selling at wholesale without license and colored,	8 96
5	Oleomargarine, in resemblance of yellow butter,	300 40
3	Oleomargarine, not properly placarded or stamped,	100 00
1	Oleomargarine, colored and not stamped (second offense),	485 00
3	Oleomargarine, colored (second offense),	00 00
1	Olive Oil, containing cottonseed oil,	60 00
1	Onions, Pickled, containing alum,	60 00
1	Orange Soda, artificially colored and misbranded,	25 00
2	Peaches, preserved with sulphurous acid (under Act of 1907),	00 00
1	Peanuts, coated with a shellac-like varnish,	60 00
1	Pie Filler, containing non-permitted coal tar dye,	60 00
16	Pickles, adulterated,	683 28
1	Pickles, containing alum,	00 00
1	Pickles, containing an excessive amount of benzoate of soda,	60 00
2	Pickles, Mixed, containing alum,	00 00
1	Pickles, Sweet Mixed, adulterated and preserved,	00 00
1	Pork and Beef Sausage, Fresh, preserved with sulphurous acid,	100 00
1	Potatoes, decomposed,	00 00
1	Raspberry Sparkler, misbranded,	25 00
5	Renovated Butter, selling without a license,	97 00
5	Sausage, adulterated,	296 40
9	Sausage, containing added starch and water,	480 00
2	Soda Water adulterated,	50 00
1	Soda Water, artificially colored,	50 00
3	Soda, colored with a coal tar dye,	80 00
47	Soda, sweetened with saccharin,	730 00
1	Soda, sweetened with saccharin and colored with a coal tar dye,	27 50
1	Strawberry Extract, misbranded,	00 00
1	Strawberry Extract, unwholesome and deleterious to health,	60 00
1	Strawberry Klondike Frost, containing coal tar color,	25 00
1	Strawberry Pop, containing saccharin,	25 00
1	Strawberry Soda, artificially colored and containing saccharin,	50 00
14	Tomato Catsup, adulterated,	851 28
3	Tomato Catsup, containing an excessive amount of benzoate of soda,	187 84
1	Tongue, tainted,	60 00
6	Vinegar, Cider, adulterated,	248 50
1	"Whip E Z," containing saponin,	60 00
667		$30,405 84

NUMBER OF CASES TERMINATED DURING THE YEAR 1910 AND THE ACT UNDER WHICH SAME WERE PROSECUTED

Oleomargarine act, 1901,	231
Renovated butter act,	5
Food act, 1907,	8
Food act, 1909,	143
Milk act, 1901,	5
Milk act, 1909,	90
Lard act, 1909,	5
Vinegar act, 1901,	6
Non-alcoholic drink act, 1909,	67
Ice cream act, 1909,	63
Meat act (fresh), 1905,	1
Fruit syrup act, 1905,	3
Egg act, 1909,	40
Total,	667

REPORT OF THE ECONOMIC ZOOLOGIST

Harrisburg, Pa., *January 1, 1911.*

Hon. N. B. Critchfield, *Secretary of Agriculture:*

Dear Sir:—I take pleasure in submitting the following as the Report of the Economic Zoologist for the year 1910, being my Eighth Annual Report:

As previously announced, the work of this office was originally undertaken under the following heads:

1. Examining Specimens and Answering Questions Sent.
2. Personal Work: Investigations and Experimentation.
3. Publications.
4. Lectures.
5. Inspection of Nurseries and Private Premises.
6. Inspection of Imported Plants, Seeds and Fruits.
7. Making Collections.

As the work grew, we found it was necessary to another division, which is here designated as "No. 8. Demonstrations." In fact, it now appears that the demonstration work is at present the most important of all.

It appears that the work of this office during the past year has been remarkably successful, as indicated by the great number of letters and newspaper articles expressing appreciation of the aid received through it. A special effort continuously has been to make the work thoroughly practical and to meet the needs of the agricultural people, and at the same time to maintain as high scientific standard as is possible.

The greatest difficulty with many scientists has been that their work has been of a nature too technical to be useful to the average farmer. It is possible that in the continuous effort to avoid this we may be charged with having extended toward the opposite extreme, but it is certain that in practical results the office has achieved enough to be gratifying to all persons concerned.

The duties of the office have increased to a remarkable extent, owing to the evident increase in the destructiveness by insect pests and plant diseases, especially to the awakening interest being taken in these and other subjects in natural history, practical agriculture, and horticulture in Pennsylvania.

The fact that the public is well informed along the lines pertaining to the duties of this Bureau of the Department of Agriculture, through our periodical bulletins and the Weekly Press Letter, relieves us to a great extent from the necessity of a detailed report herein to be given, but it is desirable to record the progress made under the different headings above mentioned.

1. EXAMINING SPECIMENS AND ANSWERING QUESTIONS SENT

During the past year we have made 1,220 accessions (comprising many more specimens) to the collection of specimens, most of which have been contributed by correspondents in this State, as well as others, chiefly for the purpose of requesting examinations and gaining information concerning the material sent. These are acknowledged in that portion of this Report entitled, "Making Collections."

The correspondence has been remarkably large. During the one year 7,732 letters have been written and copied in this office, which does not include the minor correspondence not copied, nor a great number of circulars sent out. Of these letters, 693 have been to the field inspectors and demonstrators of the office, and, like all the others, have been in response to inquiries received, or for the purpose of acquiring all instruction possible, or disseminating official information.

To relieve considerable of the correspondence, we made a particular effort to prepare timely articles in a terse and practical manner as Press Bulletins, to be sent to the newspapers of the State. Extra numbers of these were printed and kept on file under a systematic method, and sent in answer to inquires on the topics they treat.

2. PERSONAL WORK: INVESTIGATION AND EXPERIMENTATION

The investigations of this office have been conducted along those lines that were most needed in the practical suppression of pests, particularly in Economic Entomology. Of the destructive insects, the chief one, because of its wide-spread importance, has been the San José scale. Fortunately, the ravages of this fearful destroyer in our orchards are now well checked, and the pest is under control in those orchards where the methods have been adopted which we have recommended.

By reference to the Annual Report of this office of five years ago, page 130, it will be seen that we then made the emphatic statement that *"the lime-sulfur wash boiled for one hour, and applied while the leaves are off the trees, or when the trees are dormant, is positively the best means of killing the San José scale, the safest and least injurious to the infested trees, and the least expensive material that can be effectively applied for this pest."* Five years of active warfare against the pest, in almost every county of this State by us, and in almost every state in the Union by others, have proven beyond all controversy the emphatic truth of the above statement.

Eight years ago we commenced to experiment with various materials for the San José scale, and soon arrived at the conclusion that the best, cheapest and safest was the lime-sulfur solution. Unfortunately, we had the opposition of those persons who advocated certain other materials, and especially of the agents and manufacturers of the oil solutions, and there was altogether a lack of uniformity in the recommendations of the Economic Entomologists of the country.

At the present time practically all are agreed upon the truth of the above statement in every regard. The lime-sulfur solution is not only made very extensively by commercial and smaller orchard

owners, but is also prepared commercially by no less than about two scores of manufacturers. It can now be purchased in small and large quantities of various local dealers, such as druggists and hardware dealers, or seedsmen. But as it is yet much cheaper to make it for one's self, our progressive orchardists are doing this and saving money thereby. In the course of a short time, the price of the commercial lime-sulfur solutions will be considerably reduced, and orchardists will be prepared not only to make it for themselves, but, in emergency, to buy from their neighbor or dealer.

While the formula has been changed during the past year, the fundamental facts, as expressed in the above quotation, remains the same, and the "lime-sulfur solution boiled one hour is the best remedy," not only for the San José scale, but also for the Oyster-shell scale, Scurfy scale, Pear leaf blister mite, and other insects that can be reached on the exposed parts of trees during their dormant period.

Considerable advance has been made in the use of this material by the hydrometer, which is an instrument for testing its strength. While it is impossible to apply the lime-sulfur solution at a strength that will injure the trees when dormant, it is easy to get it so dilute that it will not destroy the scale. This, in fact, is often done, and in most instances the recommendations of dealers and agents in regard to dilution results in making the material so dilute that the scale is not controlled. The test with the hydrometer should show the strength equal to 1.03 or stronger when diluted and ready to apply.

The formula for boiling has at last been reduced to simplicity, as one can make a concentrated, storable lime-sulfur solution of the best quality by boiling two pounds of powdered sulfur with one pound of quick lime of fair quality, for one hour, and straining and storing this without the sediment. This will not crystallize, as it would when made by the old 17-22-50 formula, and when ready to use should be dilute with about six or seven times its bulk of water, or, more accurately, tested with a hydrometer.

Our most recent investigations have proven that it is not necessary to go to the expense and trouble of obtaining the freshly-burned lime in order to make the lime-sulfur solution that will kill the scale, although this, of course, is better. We have also proven that good and effective lime-sulfur solution can be made with air-slaked lime boiled with sulfur, by using an amount of about equal parts of air-slaked lime and sulfur, or one pound of each in each gallon of water, boiled one hour. It is better, however, to use a good grade of lime, and in order to keep it fresh it should be slaked and kept under water in some vessel. If water is kept over it, the lime will be ready for use at all times, and all that is necessary is to take three times as much of the wet lime paste as would be required of the dry fresh stone lime.

Further investigations have also proven that the dilute lime-sulfur, whether commercial or homemade, is one of the best fungicides, if not the very best, that can be used. In our own experiments and chemical analyses we proved, during the past two years, that arsenate of lead could be used with this, and although it caused a black

precipitate, it was not ineffective as an arsenical poison, making thus a combined insecticide and fungicide. Therefore, the formula that is now recommended as a summer spray for these dual purposes, is as follows:

On potatoes and other hardy plants, one gallon of strong concentrated lime-sulfur solution, and one and one-half or two pounds of arsenate of lead to twenty-five gallons of water. On apple, pear, quince and other fairly hardy plants, one gallon and one quart of the strong lime-sulfur solution, and two pounds of arsenate of lead in fifty gallons of water. On very delicate plants, like the peach, one gallon of strong lime-sulfur solution, and four pounds of arsenate of lead in two hundred gallons of water.

It is fortunate that the time has come when the horticulturist and agriculturist can, with only three materials, keep in control the pests that are liable to assail and destroy his growing property. These materials are the two mentioned above for the chewing insects and plant diseases, and also for the scale insects during their dormant season, and whale oil soap, or tobacco, or kerosene, for the sucking insects,—such as plant lice and young scale insects during the summer time.

We have proven that Peach-tree borers, which are really the worst insect enemies of the peach, since the San José scale is so easily controlled, can be prevented and controlled by spraying or washing the base of the peach trees about the middle of the month of June, with a strong lime-sulfur solution to which has been added arsenate of lead, and then mounding the trees.

The regular winter formula of lime-sulfur, especialy with sediment present, and containing one or two pounds of arsenate of lead to fifty gallons, applied to the base of peach trees has, in ninety-nine per cent. of the cases tried by us, resulted in preventing any attack by the Peach-tree borer. We recommend that this be applied from the middle to the last of June, and that the trees be at once mounded to a height of about six inches or a foot, being sure that the liquid has covered the bark both above and below the top of the mound of earth.

White Lead and Raw Linseed Oil on Fruit Trees: A great deal has been published recently concerning the effects of white lead and linseed oil on fruit trees. We used it two, three and four years ago on peach, apple and pear trees, being careful to apply pure white lead and pure raw linseed oil. One application was made, but it was thorough, being appied with a brush to the trunk of the tree down to the ground. The trees showed absolutely no effects of injury, excepting a slight cracking of the very outermost bark layer to which the paint was directly applied. It is probable that this was no more than the natural splitting or cracking of the bark in the process of growth. The borers of the pome fruits were effectually prevented, as well as no damage by mice and rabbits. While we would not recommend the regular annual application of oil, we think it would be safe to use it at least once every two years.

Owing to the lack of facilities in the way of a place for experimental work, the experimentation of this office has not been extensively conducted during the past year.

The investigations of certain important insects which were begun some time ago are continued, the only handicap being the lack of a place to conduct proper investigations and experiments on living trees, without the danger of destroying personal property by experimentation. Nearly all tree owners are willing to have us demonstrate on their premises, but experimenting is different from demonstrating, and may have adverse results. This office seriously needs a small experimental plot or orchard.

3. PUBLICATIONS

Among the publications of the office have been the Monthly Bulletin of the Bureau of Zoology, of which Volume VII was completed and indexed. With this the Monthly Bulletin ceased, and the Bi-monthly takes its place.

The Weekly Press Letter, discussing timely topics of interest and importance was issued regularly every Tuesday through the year to the newspapers of this State. The press has learned to look for its coming and uses it extensively. Nothing has done more to carry the practical work of this office to the farmers at the exact time needed than this Weekly Press Letter. Incidentally, it has also resulted in very materially increasing the correspondence and duties in the office.

4. LECTURES

The Economic Zoologist has given considerable time and energy to public lectures at meetings of various kinds, speaking chiefly on the subjects of pest suppression, bee-keeping, orcharding and plant preservation. In all, forty-five lectures or addresses were made during the year.

5. INSPECTION OF NURSERIES AND PRIVATE PREMISES.

(A) Nursery Inspection

Great care was given to the inspection of nurseries in Pennsylvania during the summer, as well as during the winter, continued by Mr. E. B. Engle as the Chief Nursery Inspector. This means that there were two complete inspections of each nursery in this State. The summer inspection was commenced on the first of August and continued as rapidly as possible, with three inspectors in the field, until the work was completed in September.

The winter inspections were begun on the first of February as has been our custom during the past two years, and was likewise continued with three inspectors in the field until all the nurseries were inspected, and methods adopted for the extermination of San José scale from each nursery wherein it has been found. The need of winter inspection of nurseries is to be seen in the fact that the summer inspections in some instances must be completed before the young San José scale has ceased to move, and, consequently, carried from place to place, and the trees which may be found clean during the inspection in August might also be infested by the scale being carried to them before the approach of the dormant season.

Also, the presence of leaves on the branches prevents a careful and thorough inspection of all parts that can more easily and certainly be given when the foliage is not present. Therefore, the February inspection of nurseries was undertaken under the direction of the Secretary of Agriculture with a view to perfecting this important service for our tree growers by being more nearly certain of detecting the presence of such pests by means of inspections when the trees are dormant.

The more careful efforts have been made to insure the destruction of all infested nursery stock, and the fumigation of all stock to be sold or shipped from nurseries in which San José scale was found during the previous inspection.

While the list of nurserymen published below does not indicate the nurseries in which the scale was found, it is enough to say that all listed have complied with the requirements of our State law in regard to the destruction of infested stock, and have made affidavit that they will fumigate the remaining stock before shipping:

REPORT OF CHIEF NURSERY INSPECTOR

Since January 1, 1910, 188 nurseries were inspected in the State, 187 of which received certificates. Of the 188 nurseries, 136 grow general nursery stock in greater or lesser quantity and variety, on plots ranging in size from 1-8 to 600 acres. The remaining 52, while granted nurserymen's certificates, confine their efforts to small fruit plants only, including strawberries, raspberries, and blackberries, in some instances the sale of plants being only incidental, the growing of berries being the primary object. Where berry growers confine their attention to strawberries only, no inspections are made nor certificates given unless by special request, where plants are intended for shipment by express or freight in which cases transportation companies are required to see that certificates accompany the shipments.

The total acreage of the nurseries, 188 in number, is 3,175. Of these 182 acres are devoted to berry or small fruit nurseries, leaving a net area 2,995 acres devoted to the growing of general nursery stock. There are 11 nurseries in the State having 50 acres or more, six having 100 or over, and three containing 400 or more acres. During the present year 30 nurseries have been added to our list, and 18 have gone out of business, a net gain of 12 for the year.

In addition to regular certificates to nurserymen, there have been issued to persons residing in the State, 98 Agent's and Dealer's Certificates, and two have been granted to non-residents.

One hundred and seventy nursery firms outside of Pennsylvania have filed Affidavits of Fumigation in this office, 73 being from New York, 33 from Ohio, 15 from New Jersey, 6 each from Illinois, Maryland and Massachusetts, and the remaining 31 from 14 different states, including Alabama, Connecticut, Delaware, Georgia, Indiana, Iowa, Kentucky, Michigan, Maine, Missouri, North Carolina, Tennessee, Wisconsin and Virginia.

Winter inspection of the past year was somewhat delayed, and in a measure interfered with by the necessary inspection of a number of importations from foreign countries. The discovery during

the previous year, (1909) that nests and larvae of Brown-tail moth were being found on importations, especially those from France and Germany, made a thorough and careful inspection of all susceptible stock from those countries imperative. This work required an unusual amount of time and labor at times, and a temporary increase of inspectors was deemed necessary in February and March of the present year. While the importations for 1910 were considerably in excess of those of the previous year, much of the stock consisted of evergreens which is usually less liable to infestation than fruit or decidious trees and seedlings. About 1,500 cases were inspected, and nearly 100 "nests" or tents of Brown-tail moth found. No nests nor eggs of Gipsy moth were discovered, but on an importation from Japan several new insects and eggs were found.

In addition to the insect pests liable to be found on imported nursery stock, information was also received from the Departments at Washington, D. C. and New York, that a very serious fungous disease of the White Pine was being introduced on importations from Germany. It was described as "Blister Rust," and is deemed of sufficient importance to require careful attention in order to preserve our Pines from destruction. A special inspection of this kind of stock was made in June, and while but few infected trees or plants were found, a close supervision and inspection of White Pine trees and seedlings will be continued. It is usually found on young seedlings after the second or third year, and is propagated by spores that alternate between the evergreens and the Ribes family: gooseberries, currants, etc. It is claimed that it can be controlled or prevented from spreading by the destruction of all Ribes in proximity to the Pines.

The danger to the White Pines in this country from this disease is deemed of so much importance that a Bill is now pending in Congress authorizing the Secretary of Agriculture of the United States to enforce a strict quarantine against any foreign countries where it is known to exist, until satisfied that it has been eradicated or is completely under control.

The regular Annual Inspection for 1910 was begun August 1st and continued until the work was completed about Oct. 1.

Special attention has been given to the San José scale, while Scurfy and Oyster-shell scale, Woolly Aphis, Crown Gall, Black Knot, and Yellows have also received careful attention.

In view of the unfavorable weather conditions that usually prevail during February and March when our winter inspections are made, I would suggest that henceforth the inspection be made during November and December, or as soon as the trees have dropped their foliage. There is no doubt that the work can be more expeditiously and economically done then than in midwinter, when deep snows and almost impassable roads are liable to occur.

The inspections of imported bulbs and greenhouse plants has received some attention during the past autumn months. A tiny mite, that is evidently doing serious damage to bulbs in many cases, has been found in foreign consignments. In fact its presence has been evident in every consignment inspected. To carefully inspect all the bulbs imported into Pennsylvania each season, would be almost impossible, even if deemed necesary, and our work has been con-

fined to the inspection of occasional consignments, when time and opportunity would permit. We are informed that in other states no effort is being made to inspect bulb importations. Objectionable work has also been done in the inspection of premises adjoining nurseries, and with few exceptions, a single notice to the owners of such premises has been sufficient to secure their co-operation in this direction.

I am glad to note that the nurserymen of the State are offering their assistance and encouragement to the work of nursery inspection, and with our inspectors are working earnestly to prevent the introduction and dissemination of injurious pests and diseases. A marked improvement in conditions generally has been noted during the year just past.

The following is a full list of the Pennsylvania Nurserymen, with address and acreage of each:

LIST OF NURSERIES IN PENNSYLVANIA

ADAMS COUNTY

Name	Place	Acres	Certificate number
W. W. Boyer & Bro.,	Arendtsville,	½	1726
E. P. Garretson,	Biglerville,	¼	1481
H. G. Baugher Propr. The Adams Co. Nursery,	Aspers,	4	1583
C. A. Stoner,	Gettysburg,	2	1679
Charles J. Wilson, R. F. D.,	Gettysburg,	4	1576
H. R. Plank,	York Springs,	2	1581
Oyler & Hartman, R. D. No. 5,	Gettysburg,	2	1580
Cornelius Bender, R. D. No. 2,	Aspers,	¾	1577

ALLEGHENY COUNTY

Elliott Nursery Co.,	Springdale,	30	1621
August G. Espe, R. D. No. 2,	Perryville,	2	1720

BEAVER COUNTY

James W. Mackall,	Beaver,	15	1623
R. C. Mackall,	Beaver,	10	1712
J. Hoyt,*	Industry,	10	1544
A. P. Goodwin,	Industry,	6	1542
A. J. Freed,*	Racine,	2	1540
W. A. Freed,*	Racine,	2	1539
Joseph and Charles Engle, R. D. No. 2,*	Beaver,	7	1541
Leonard Arnold, R. D. No. 1,*	Beaver Falls,	5	1608
Enoch Engle, R. D. No. 1,*	Beaver,	7	1543

*Grow berry or small fruit plants only.

LIST OF NURSERIES IN PENNSYLVANIA—Continued

BEDFORD COUNTY

Name	Place	Acres	Certificate number
Austin Wright,	Alum Bank,	1	1624

BERKS COUNTY

Wenrich Bros.,	Robesonia,	½	1635
Bertrand H. Farr,	Wyomissing,	5	1628

BLAIR COUNTY

Geo. S. Burket,	Claysburg,	½	1578
E. F. Giles,	Altoona,	4	1717

BRADFORD COUNTY

Samuel H. Madden, U. S. Weather Bureau, Columbus, Ohio. Nursery at,	Granville Summit,	½	1620

BUTLER COUNTY

Pierce Bros.,	Butler,	5	1538

BUCKS COUNTY

J. L. Lovett,	Emilie,	5	1686
Henry Palmer,	Langhorne,	4	1664
Horace Janney,	Newtown,	5	1667
D. Landreth Seed Co.,	Bristol,	2	1665
The W. H. Moon Co.,	Morrisville,	400	1680
Samuel C. Moon,	Morrisville,	60	1633
D. J. Youngken,	Richlandtown,	1	1659
Jacob F. Krout, R. D. No. 1,	Perkasie,	2	1643
Penna. R. R. Co., Forestry Department, E. Sterling, Forester, Philadelphia, Pa., Nursery near,	Morrisville,	20	1697

CENTRE COUNTY

State College, Department of Horticulture,	State College,	1	1721

LIST OF NURSERIES IN PENNSYLVANIA—Continued

CHESTER COUNTY

Name	Place	Acres	Certificate number
James Donoghue,	Kennett Square,	¾	1675
W. H. Doyle,	Berwyn,	8	1626
The Morris Nursery Co.,	West Chester,	200	1610
The Conard & Jones Co.,	West Grove,	20	1618
The Dingee & Conrad Co.,	West Grove,	15	1579
The Rakestraw Pyle Co.,	Kennett Square,	200	1681
J. A. Roberts,	Malvern,	6	1630
Hoopes Bro. & Thomas Co.,	West Chester,	600	1615
J. B. Reif,	Spring City,	1	1695
E. B. Keating,	Kennett Square,	½	1683
Louis B. Eastmurn,	Kennett Square,	5	1674
E. W. Twadell, (1212 Market St., Philadelphia, Pa.),	Westtown,	3	1688
H. H. Corson & Son,	Avondale,	1	1716

CLEARFIELD COUNTY

W. S. Wright,	Clearfield,	⅛	1575

COLUMBIA COUNTY

Philip Harris, R. F. D.,	Light Street,	½	1609
T. D. Robbins,	Light Street,	⅛	1672

CRAWFORD COUNTY

David Kelty,*	Cochranton,	1½	1595
M. N. Shepard,*	Cochranton,	2	1593
Anderson Bailey, R. D. No. 66,*	Cochranton,	13	1594
Henry Roberts, R. D. No. 66,*	Cochranton,	7	1596
J. T. Reed, R. D. No. 66,*	Cochranton,	1	1597
Samuel J. Cooper, R. D. No. 58,*	Cochranton,	4	1566
Lewis E. Swogger, R. D. No. 28,	Carlton,	1	1565
J. Q. Marsh,*	Geneva,	5½	1560
L. L. Wood,*	Geneva,	4⅛	1569
Peter Schaffner, R. D. No. 2,*	Meadville,	3	1564
Wm. Shellito, R. D. No. 41,	Linesville,	1	1563

CUMBERLAND COUNTY

B. F. Cocklin, R. D. No. 2,	Mechanicsburg,	½	1528

*Grow berry or small fruit plants only.

LIST OF NURSERIES IN PENNSYLVANIA—Continued

DAUPHIN COUNTY

Name	Place.	Acres	Certificate number
M. S. Brinser,	Middletown,	2	1678
The Berryhill Nursery,	Harrisburg,	5	1642
C. P. Scholl, R. D. No. 1,	Halifax,	3½	1625
Andrew Coble, R. D. No. 1,*	Middletown,	5	1676
C. B. Landis,	Penbrook,	¼	1622
J. M. Christman,	Port Hunter,	⅛	1700

DELAWARE COUNTY

P. Z. Supplee and Son,	Collingdale,	25	1694
J. J. Styer,	Concordville,	2	1651
M. J. Porter,	Wayne,	5	1650
C. H. Pettiford,	Lansdowne,	1	1652
W. E. Caum (Lessee),	Haverford,	12	1715
John G. Gardner,	Villa Nova,	5	1649
H. H. Battles,	Newtown Square,	10	1692
Otto Lochman & Co.,	Wallingford,	1	1701

ERIE COUNTY

Penna. Nursery Co.,	Girard,	50	1562
Miss F. C. Day,*	Girard,	1	1559
L. C. Hall,	Avonia,	¼	1561
H. C. Pettis,	Platea,	¼	1558
A. F. Youngs,	North East,	5	1547
Orton Bros.,*	North East,	1½	1550
D. C. Bostwick & Son,	North East,	4	1554
L. G. Youngs,	North East,	10	1551
M. E. Kelly, R. D. No. 2,*	North East,	2	1553
A. J. Youngs,*	North East,	¼	1552
W. E. Smith, R. D. No. 3,*	North East,	4	1548
J. G. Bagley,*	North East,	1	1549
W. S. Waldo Nursery Co.,	North Girard,	¼	1568
Kidder Bros., R. D. No. 3,*	Girard,	3	1567
Perry Goodrich,*	North East,	2¾	1556
F. R. Taber,*	North East,	2	1555
C. H. Mottier & Sons Co.,*	North East,	5	1616
Stark Bros. Nurseries & Orchards Co.,	North Girard,	60	1614
E. A. Baron,	McKean,	¼	1719
E. J. Allis, R. D. No. 8,	Erie,	½	1727

FRANKLIN COUNTY

Penna. Department of Forestry, Prof. E. A. Ziegler, (Forester), Mont Alto Nursery,	Mt. Alto,	5	1693
Henry Eicholz,	Waynesboro,	¼	1705
Penna. Department of Forestry, Robt. G. Conklin, (Forester, Caledonia Nursery,	Fayetteville,	⅛	1696

*Grow berry or small fruit plants only.

LIST OF NURSERIES IN PENNSYLVANIA—Continued

FULTON COUNTY

Name	Place	Acres	Certificate number
Frank P. Pleisinger,*	Loust Grove,	2	1723

GREENE COUNTY

Perry M. Rush, R. D. No. 1,	Sycamore,	¼	1710

JUNIATA COUNTY

John K. Oberholtzer,*	Mifflintown,	2	1585
S. H. Graybill,*	Richfield,	5	1533
Wm. Banks,*	Mifflintown,	10	1584
John H. Shellenberger,*	McAllisterville,	5	1586

LACKAWANNA COUNTY

Elmer E. Richards,*	Baldmount,	½	1658
John W. Shepherd, 45 Clay Ave.,	Scranton,	4	1702
Daniel O'Hara,	Dunmore,	¼	1657
Harlan Jacoby, R. D. No. 2,	Clarks' Summit,		1725

LANCASTER COUNTY

John G. Engle,	Marietta,	½	1571
Maurice J. Brinton,	Christiana,	20	1706
W. P. Bolton, R. F. D.,	McCall's Ferry,	2	1699
D. D. Herr,	Lancaster,	18	1619
Wilson Kreardy,	Mt. Joy,	1	1703
O. W. Laushey,	Bird-in-Hand,	2	1707
A. W. Root & Bro., R. D. No. 1,	Manheim,	20	1709
David S. Herr, R. D. No. 7,	Lancaster,	---	---
M. H. Musser,	Lancaster,	5	1582
B. F. Barr & Co.,	Lancaster,	3	1714
Frank A. Suter,	Lancaster,	½	1632
Mayer & Son,	Willow Street,	2	1634

LAWRENCE COUNTY.

Butz Bros.,	New Castle,	¾	1604
A. S. Moore,	New Castle,	1	1603

*Grow berry or small fruit plants only.

LIST OF NURSERIES IN PENNSYLVANIA—Continued

LEHIGH COUNTY

Name	Place	Acres	Certificate number
W. B. K. Johnson Estate,	Allentown,	4	1690
Preston J. Kline,	Coopersburg,	2	1645

LUZERNE COUNTY

Miss M. A. Maffett,	Wilkes-Barre,	1	1690

MERCER COUNTY

H. H. McClearn,*	Stonesboro,	4	1601
D. C. McClearn,*	Stonesboro,	1½	1598
Geo. W. Proud,*	Stonesboro,	2	1599
O. P. McLean,*	Greenville,	1	1592
W. M. Doyle,*	Stonesboro,	10½	1600
Robert Doyle,*	Stonesboro,	5½	1588
J. W. Nelson,*	Volant,	14	1607
George E. Brocklehurst, R. D. No. 20,*	Jackson Centre,	5	1587
J. T. McLean, R. D. No. 46,*	Greenville,	3	1591
J. L. Hoobler & Sons, R. D. No. 34,*	Hadley,	2	1590
W. R. Cribbs,*	Mercer,	5	1606
H. W. Allison, R. D. No. 9,*	Mercer,	4	1605
J. E. Brocklehurst,*	Mercer,	1	1589

MIFFLIN COUNTY

Penna. Department of Forestry, Geo. A. Retan, Forester, Nursery and Forest reservation near Greenwood, Huntingdon Co., Pa.,	Belleville,	2½	1613

MONTGOMERY COUNTY

Alexander Cummings & Son,	Centre Square,	1	1646
Chris Koehler,	Cheltenham,	2	1661
R. B. Haines Co.,	Cheltenham,	10	1666
J. B. Heckler,	Lansdale,	4	1660
J. W. Thomas & Sons,	King of Prussia,	90	1641
J. Krewson & Sons,	Cheltenham,	25	1662
T. N. Yates & Co.,	North Wales,	75	1689
J. B. Moore,	Hatfield,	5	1687
Adolph Mueller,	Norristown,	12	1631
Thomas Meehan & Sons,	Dresher,	225	1640
Wm. Sturzebechher,	Lansdale,	2	1644
Edward D. Drown,	Weldon,	½	1676
J. G. Steffin,	Norristown,	2½	1629
Somerton Nurseries, A. U. Bannard, Mgr., 125 5th St., Philadelphia,	Somerton,	15	1638
A. E. Wohlert,	Narberth,	10	1639

*Grow berry or small fruit plants only.

LIST OF NURSERIES IN PENNSYLVANIA—Continued

MONROE COUNTY

Name	Place	Acres	Certificate number
E. M. Werkeiser, Forest Plants and Seedlings,	Somerton,	15	1638
W. K. LaBar,	Mt. Pocono,	¼	1713

NORTHAMPTON COUNTY

Theodore Roth,	Nazareth,	½	1654
Hays Nursery Co.,	Easton,	1	1653

NORTHUMBERLAND COUNTY

Francis W. Peiffer, R. F. D.,*	Fishers Ferry,	2½	1671

PERRY COUNTY

Geo. A. Wagner, R. F. D.,	Landisburg,	4	1708
Robert Kreitzer, R. D. No. 1,*	Liverpool,	½	1532

PHILADELPHIA COUNTY

Chas. A. Knapp, 7634 Carson St.	Chestnut Hill,	4	1636
W. W. Harper,	Chestnut Hill,	500	1682
Thos. Meehan & Sons, Inc.,	Germantown,	45	1647
T. N. Yates & Co.,	Mt. Airy,	6	1668
John B. Lewis,	Torresdale,	15	1637
A. F. O'Connell, 4103 Girard Ave.,	Philadelphia,	80	1627
John Stephenson's Son,	Oak Lane,	2	1669

POTTER COUNTY

Perry Brigham,	Ulysses,	½	1536

*Grow berry or small fruit plants only.

LIST OF NURSERIES IN PENNSYLVANIA—Continued

SNYDER COUNTY

Name	Place	Acres	Certificate number
T. G. Arbogast,*	Swineford,		1724
John F. Boyer, R. D.,*	Middleburg,	10	1535
Philip A. Apple, R. F. D.,*	Middleburg,	5	1530
Fred. G. Moyer,*	Freeburg,	1½	1534
A. W. Rohrer,*	McKees Half Falls,	2	1531

SOMERSET COUNTY

M. T. Lancaster,	Harnedsville,	2	1572
H. E. Purbaugh,	Harnedsville,	½	1573

SUSQUEHANNA COUNTY

E. A. Smith,*	Heart Lake,	7	1656
Geo. P. Sprout, R. D. No. 66,*	Montrose,	6	1655

TIOGA COUNTY

Arthur Edwards,	Elkland,	¾	1545
Homer B. Howe,*	Wellsboro,	3	1574
Penna. Department of Forestry, Paul H. Mulfo Forester,	Aspah,	14	1611
James W. Lain,*	Jackson Summit,	1	1722

UNION COUNTY

C. K. Sober, (nursery near Paxinos, Northumberland Co.),	Lewisburg,	18	1648

VENANGO COUNTY

Venango Nursery Co., R. F. D.,	Franklin,	4	1602

*Grow berry or small fruit plants only.

LIST OF NURSERIES IN PENNSYLVANIA—Continued

WESTMORELAND COUNTY

Name	Place	Acres	Certificate number
John McAdams,	Mt. Pleasant,	1	1570

WYOMING COUNTY

F. H. Fassett,*	Meshoppen,	1¾	1557
H. S. Hitchcock,*	Laceyville,	¼	1617
W. E. Shoemaker,*	Laceyville,	2	1711

YORK COUNTY

Patterson Nursery Co.,	Stewartstown,	25	1704
Geo. E. Stein,	East Prospect,	6	1546
W. S. Newcomer,	Glenrock,	4	1677
E. J. Weiser, R. D. No. 7,	York,	¼	1685
F. E. Cremer,	Hanover,	1	1684

*Grow berries or small plants only.

(B). Inspection of Private Premises

During the past year the orchard inspection and demonstration work was pushed along as rapidly and systematically as possible. The employes were faithful in the service, and wonderful results were obtained. The names of the inspectors who did this work in charge were as follows:

Allaman, R. P., New Cumberland, Pa. (part time).
Benn, M. L., Coudersport, Pa.
Bergy, James, Mifflintown, Pa.
Bowers, E. C., East Petersburg, Pa.
Briggs, J. S., Norristown, Pa.
Bullock, W. H., Honesdale, Pa.
Burk, Paul H., Reading, Pa.
Cox, J. W., New Wilmington, Pa.
Ebert, Carl, Holmesburg, Pa. (part time).
Fertig, Fred R., Lebanon, Pa.
Finn, Allen O., Clifford, Pa.
Foster, T. C., Winfield, Pa.
Fox, Cyrus T., Reading, Pa.
Gish, Wm. G., Pittsburg, Pa. (part time).

Grim, J. S., Kutztown, Pa. (part time).
Knuppenburg, D. A., Lake Carey, Pa.
Lee, Ross F., Bedford, Pa. (part time).
Loux, E. L., Souderton, Pa.
McClure, F. L., New Wilmington, Pa.
McNett, E. L., Elmira, N. Y. (part time).
Markel, Earl P. (part time).
Moore, B. S., Kulpsille, Pa.
Murray, D. E., Catawissa, Pa.
Peirce, E. F., York, Pa.
Shay, M. E., Holmesburg, Pa.
Windel, Francis, West Chester, Pa.

SUMMARY ORCHARD INSPECTION

A SUMMARY OF THE YEAR'S INSPECTION WORK AS GIVEN BY THE DIFFERENT COUNTIES IS AS FOLLOWS

Counties	Number of apple trees inspected.	Number of pear trees inspected.	Number of peach trees inspected.	Number of plum trees inspected.	Number of cherry trees inspected.	Number of quince trees inspected.	Totals.
Adams,	133	14	30	12	4	------	193
Allegheny,	14,850	7,865	6,186	4,455	2,441	------	35,797
Armstrong,	------	------	------	------	------	------	------
Beaver,	------	------	------	------	------	------	------
Bedford,	------	------	------	------	------	------	------
Berks,	27,798	3,350	7,798	2,288	1,548	100	42,882
Blair,	------	------	------	------	------	------	------
Bradford,	69,837	7,605	32,940	10,041	12,956	------	133,379
Bucks,	31,244	5,027	23,019	3,629	59	------	62,978
Butler,	50,993	3,848	9,856	6,135	939	------	71,771
Cambria,	------	------	------	------	------	------	------
Cameron,	------	------	------	------	------	------	------
Carbon,	565	52	185	37	22	------	861
Center,	------	------	------	------	------	------	------
Chester,	8,447	1,617	2,491	1,175	326	------	14,056
Clarion,	------	------	------	------	------	------	------
Clearfield,	61,838	3,263	6,583	4,080	4,668	------	80,432
Clinton,	------	------	------	------	------	------	------
Columbia,	------	------	------	------	------	------	------
Crawford,	317	68	18	------	------	------	403
Cumberland,	202	28	18	12	14	------	274
Dauphin,	233,433	15,348	17,176	9,366	15,816	120	293,259
Delaware,	5,954	1,441	1,497	353	59	------	9,304
Elk,	------	------	------	------	------	------	------
Erie,	10,582	272	148	236	19	------	11,257
Fayette,	------	------	------	------	------	------	------
Forest,	------	------	------	------	------	------	------
Franklin,	75,860	6,662	40,716	6,225	3,051	------	131,514
Fulton,	58,425	4,227	13,441	7,284	7,155	------	90,532
Greene,	15,247	1,742	8,485	3,678	2,794	105	32,051
Huntingdon,	------	------	------	------	------	------	------
Indiana,	------	------	------	------	------	------	------
Jefferson,	------	------	------	------	------	------	------
Juniata,	402	16	300	24	------	------	742
Lackawanna,	185	37	101	23	19	------	365
Lancaster,	------	------	------	------	------	------	------
Lawrence,	1,200	------	------	------	------	------	1,200
Lebanon,	133	15	74	75	20	------	317
Lehigh,	------	------	------	------	------	------	------
Luzerne,	------	------	------	------	------	------	------
Lycoming,	------	------	------	------	------	------	------

SUMMARY ORCHARD INSPECTION—Continued

Counties	Number of apple trees inpsected	Number of pear trees inpsected	Number of peach trees inpsected	Number of plum trees inpsected	Number of cherry trees inpsected	Number of quince trees inpsected	Totals
McKean,	25,557	747	20	474	199	------	27,397
Mercer,	1,098	388	1,410	321	344	------	3,561
Mifflin,	------	------	------	------	------	------	------
Monroe,	------	------	------	------	------	------	------
Montgomery,	6,462	1,326	5,119	615	745	------	14,267
Montour,	------	------	------	------	------	------	------
Northampton,	19,024	3,606	18,850	2,438	468	------	44,386
Northumberland,	11,125	1,325	3,475	1,274	263	------	17,462
Perry,	------	------	------	------	------	------	------
Philadelphia,	------	------	------	------	------	------	------
Pike,	------	------	------	------	------	------	------
Potter,	------	------	------	------	------	------	------
Schuylkill,	28,436	9,035	9,900	6,050	230	------	53,651
Snyder,	4	------	3	6	------	------	13
Somerset,	------	------	------	------	------	------	------
Sullivan,	21	3	8	5	1	------	38
Susquehanna,	21,626	2,476	1,559	1,771	1,855	------	29,287
Tioga,	40,104	3,406	2,688	4,055	4,425	------	54,738
Union,	------	------	------	------	------	------	------
Venango,	150	4	50	2	------	------	206
Warren,	------	------	------	------	------	------	------
Washington,	------	------	------	------	------	------	------
Wayne,	40,619	10,158	6,552	1,968	2,610	------	61,907
Westmoreland,	------	------	------	------	------	------	------
Wyoming,	------	------	------	------	------	------	------
York,	32,641	3,419	17,939	2,978	3,330	97	60,412
Total,	896,912	98,450	238,635	81,085	65,380	422	1,380,892

It is almost incredible to think that over one and one-third million fruit trees were actually inspected by the force named above, in addition to over two thousand pubic demonstrations or visits to Supervision Orchards.

As a result of these inspections the owners were given information concerning the kinds of pests upon their premises and how to suppress them. While the chief duty of the inspector was to find the San José scale if possible, and to help in destroying this most blighting pest of our Pennsylvania orchards, they were instructed to watch for other foes that were worthy of their efforts.

Two general meetings for the inspectors were held during the year. At these meetings the Economic Zoologist delivered a series of lectures, and also gave practical work and demonstrations illustrating the methods which the men were to carry into the orchards and fields. These men were then supplied with Bulletins and other literature, and were encouraged to give all possible spare time to an advanced study of the subject which they represent. Most of them do this with great credit to themselves.

When a place was inspected the inspector left with the owner the following blank, and sent a duplicate to this office:

Circular 8.

REPORT OF ORCHARD INSPECTOR

(TO BE FILLED FOR EACH PLACE INSPECTED)

Date: .....

Time of day: .....

Dear Sir: I have today inspected your trees and shrubs at (P. O.).....

Twp., ...Co., ...and it is my duty to report as follows:

Name of Owner, ...Address, ...

Name of Tenant .....Distance and direction from Post Office, ...

			San Jose.	Scurfy.	Oyster S.	Lecan.	Other Pests (to be Named.)
No. Apple Trees,	Young,	.....Insects found.					
	Bearing,	.....Insects found.					
No. Pear Trees,	Young,	.....Insects found.					
	Bearing,	.....Insects found.					
No. Peach Trees,	Young,	.....Insects found.					
	Bearing,	.....Insects found.					
No. Plum Trees,	Young,	.....Insects found.					
	Bearing,	.....Insects found.					
No. Cherry Trees,	Young,	.....Insects found.					
	Bearing,	.....Insects found.					

Shrubbery, (Name), ...

Has this Orchard been treated for San Jose Scale?.....How many times and when? .....

With what Material? .....at what strength? .....What Results? .....

Marks: + = infested slightly; + + = considerably infested; + + + = badly infested; — = not found.

For further information, address Prof. H. A. Surface, State Zoologist, Harrisburg, Pa.

My Address: .....

.....Authorized Inspector.

At the proper season for treatment of pests the owner received from the office a letter of information, stating what pests were found, and giving him full instructions as to how to proceed to control or suppress them. This came as nearly as possible to the ideal method of individual service.

The circulars for the more common pests of orchards, which are sent to the orchardists, are as follows:

CIRCULARS

DEPARTMENT OF AGRICULTURE—DIVISION OF ZOOLOGY

THE SAN JOSE SCALE

This is the most destructive insect pest with which we have to deal, as it is liable to infest nearly all fruit trees, and a large variety of shade trees, shrubbery, and small fruits. In appearance the female San José scale is circular in shape, with a raised point in the center, surrounded by a groove or depression. The male is oblong in shape, and the raised point is excentric. This scale is about the size of a fly speck, or the dot over the letter "i" in this type.

The San José scale passes the winter about three-fourths grown, and begins to bear living young about June 1st. The young insect is minute and sulfur yellow, and crawls about the tree for two or three days seeking a favorable location to fasten permanently by inserting its beak, through which it feeds. In a few days the back of the insect becomes covered with a white, waxy secretion, later turning gray. This secretion forms a perfect cover and secure protection for the insect beneath. When about 30 days old, the females begin to produce their young, giving birth to from three to six each day for probably 30 days. One may become the progenitor of over three million in one season. These young, being of a bright lemon color, give the badly infested bark a yellowish cast early in the summer, but later when insects of all stages of development are present, the infested bark presents a grayish or ashen appearance.

The San José scale spreads only while in the free moving state, or on wood that is to be used for propagation; and can be carried by birds, insects, cattle, cats, squirrels, workmen and winds. The most wide-spread diffusion, however, was brought about some years ago by the traffic in infested nursery stock, but this is now checked by the careful inspection of nurseries everywhere.

Treatment: Seriously infested trees should be carefully pruned, cutting them back in proportion to their injury, as indicated by dead and dying limbs and the red color in the twigs. Spray infested trees, covering them entirely, from top to bottom, with Lime-sulfur Solution, using one of the following:

Lime-sulfur Solution (Home-boiled, Dilute). This is made by slaking 22 pounds of quick lime (fresh stone lime), to which is added 17 pounds of finely powdered or ground sulfur previously mixed into a paste with a little water to break up any lumps which may be present. Boil in an iron kettle in sufficient water for an hour, and dilute to make 50 gallons. Strain this well through a fine brass wire netting, having about 30 wires to the inch. Spray at once, or before the mixture gets cold.

Lime-sulfur Solution (Home-boiled, Concentrated). Slack 60 pounds of high grade lime, adding 125 pounds of fine sulfur as described above, and boil in 50 gallons of water for one hour. If necessary add water to make up for any evaporation; strain and store in closed vessels until needed or in open vessels, keeping the solution covered with a thin film of oil. When ready to spray dilute one part with 7 or 8 parts of water, or to specific gravity, as shown by Hydrometer test, of 1.04 to 1.03.

Lime-sulfur solution (Commercial Concentrated). Many manufacturers are placing upon the market ready-made Concentrated Lime-sulfur Solutions, and these are found satisfactory and about as effective as the Home-boiled Solution. They should be diluted, as a rule, by adding to one quart of the Concentrated Mixture 7 or 8 of water, or to specific gravity, as shown by Hydrometer test, of 1.04 to 1.03.

Whale Oil Soap, two pounds, dissolved in one gallon of water, applied as a spray or wash.

Common Kerosene Oil or Crude petroleum, emulsified, and used not stronger than 30 per cent. for peach and plum trees, and not more than 50 per cent. for apple and pear. (Apply only on dormant trees). All spraying should be thorough, reaching the tips of all twigs, and applied at any time when trees are dormant.

H. A. SURFACE,
Economic Zoologist.

DEPARTMENT OF AGRICULTURE—DIVISION OF ZOOLOGY

THE OYSTER-SHELL SCALE AND SCURFY SCALE

These scale insects differ from the San José in the fact that they lay eggs and, die shortly after laying, while the San José bears living young during a continuous period of some weeks. They also differ conspicuously in appearance. The San José scale is to be recognized by its circular shape, and small tip or cone in the exact center. The female of the Scurfy and Oyster-shell scales are about one-eighth of an inch in length, while the males of each species are smaller. The outer shell of the Scurfy scale is whitish, or ashy in color, and oval or fan-shaped, while the covering of the Oyster-shell is dark gray, or about the color of the bark, and the shape is, of course, that of the shell of the oyster, from which it takes its name. The male is smaller, and not so much curved as the female.

The eggs of the Scurfy scale are purple, as are, also, the young and the bodies of the parents. The eggs of the Oyster-shell are pearly white, as are the young and the fleshy bodies of the insects themselves. These, of course, are only to be seen on raising the shell of each species. Both Oyster-shell and Scurfy have two broods or generations per year in Pennsylvania. The eggs for one brood are laid in the fall and hatch during the following May, and the eggs for the next generation are laid about the last of July, and hatch in August. With each species the male dies before the eggs are laid, and the female immediately thereafter. The young hatch nearly all at one time, and crawl over the bark a few days before

fixing themselves. During the winter both of these scale insects are to be found in the egg stage under the shell or covering of the females on the bark of trees and shrubs.

Certain species of plants are more subject to injury than are others. For example, the currant bush is especially liable to be injured by the Scurfy scale, while apple, poplar, lilac, soft maple, willow, ash, and walnut trees are especially liable to damage by the Oyster-shell scale. These pests are so serious in the mountainous regions of this State as to demand thorough treatment.

Both species can be killed by spraying when the trees are dormant with the boiled Lime-sulfur Solution, made and applied the same as for San José scale, and can, also be destroyed by spraying with a dilute contact insecticide, such as one pound whale oil soap in six gallons of water, or 10 per cent. kerosene emulsion, when the young hatch in May, and again in August. Washing or painting the trees with a strong solution of Lime-sulfur, or soap, will kill scale insects of all kinds at any time.

H. A. SURFACE.

DEPARTMENT OF AGRICULTURE—DIVISION OF ZOOLOGY

LECANIUM SCALE

This is the largest scale insect infesting peach and plum trees. It is brown in color, and in shape resembles a turtle or terrapin, and for this reason is often called the "Turtle-shell" or "Terrapin" Scale. The young appear as brownish, free-moving insects in June or July.

Treatment: (1) Spray the infested trees during the dormant season with a twenty per cent. kerosene emulsion, made by using one part of the stock solution in three parts of water. The stock solution is made by dissolving one pound of soap in a gallon of hot water, and adding to this two gallons of kerosene, stirring and whipping it into a thick, creamy mass. This can be kept for us in making the dilute emulsion at any time.

(2) Spray when the young insects are found crawling upon the limbs of the trees in June or July, with an eight per cent. kerosene emulsion, made by dissolving one gallon of the stock solution in eight gallons of water, or spray with Whale Oil Soap, one pound to six gallons of water.

Since these insects are often found only on the lower sides of the twigs and limbs, they can then often be removed conveniently by rubbing them off with a stick.

H. A. SURFACE,
Economic Zoologist.

THE WOOLLY APHIS

These insects infest all parts of the tree, both above and below the ground. They usually locate in wounds in the bark made by mechanical injury, pruning, or bark cankers, where they are con-

spicuous on account of the white covering of fine, waxy threads, which are secreted on their bodies, and a group of them resembles a tuft of cotton or wool. While they make knots on branches, the great injury is done by their work on the roots, the bark of which they puncture with their beaks in their efforts to suck out the sap. This causes swellings or enlargements on the roots, not unlike crown gall. Moreover, the ants, always present with the aphids, upon the secretions of which insects they feed, tunnel about the rootlets of the trees, and separate them from the earth.

Treatment: The insects above ground can be destroyed by spraying or painting by hand with an eight or ten per cent, kerosene emulsion, or whale oil soap, one pound to five gallons of water, or with boiled lime-sulfur solution; or infested areas can be painted over with ordinary house paint. The insects underground should be treated with one of the following: Remove some of the ground near the trunk of the tree, and apply fine tobacco dust on the ground above the roots, or pour tobacco decoction, made by steeping one pound of tobacco leaves in one gallon of water on the roots of the tree, or apply eight or ten per cent. kerosene emulsion to the roots of the tree, or fumigate with carbon bisulfide by making a hole with a stick, down to the roots at several points about the tree and pour into it one-fourth pint of carbon bisulphide.

Spring spraying with the lime-sulfur solution will destroy the eggs laid upon the bark of the tree.

H. A. SURFACE,
Economic Zoologist.

DEPARTMENT OF AGRICULTURE—DIVISION OF ZOOLOGY

BORERS

The larvae of certain insects are called borers, because of their habits of boring or tunneling beneath the bark, and even into the wood of trees upon which they feed. They destroy the living bark and sap wood, thus cutting off the connection between the roots and the leaves of the trees, injuring or killing them.

The most important of these borers are the following:

The Round-headed Apple-tree Borer. This is one of the worst enemies of the apples trees. The larvae is cylindrical in shape, and first bores into the soft sap wood by making a circular tunnel, when it works into the harder wood, and after nearly three years it emerges, usually several inches above the point of entrance.

Treatment: Before the borer has entered the hard wood, it can easily be cut out by using a pointed tool, such as a pruning knife, but after it has worked its way into the wood, the best method of treatment is to inject a few drops of carbon bisulfide into the tunnel, using a spring-bottom oil can for the purpose, and closing the opening of the tunnel with soft clay.

The Flat-headed Apple Borer attacks a variety of trees. This borer makes irregular tunnels in and just beneath the bark, working into the wood only for a short distance before pupation.

Treatment: Cut it out by making up and down incisions rather than crosswise, or crush them in their tunnels by probing with a stiff wire. Follow the tunnels until the borer is reached.

The Peach-tree Borer. This is the caterpillar of a Clearwing moth which deposits her eggs near or upon the trunk of the tree during midsummer. From these eggs hatch larvae, which enter and feed upon the bark of the trunk and larger roots near the soil surface. Their presence is betrayed by their sawdust-like deposits of the wax on the bark. They mature in about one year.

Treatment: Remove the earth about the trunk of the tree with a pointed hoe or trowel, and cut out the borers with a sharp pointed knife, or crush them in their tunnels with a sharp or stiff wire. One should be careful to remove as little of the living bark as is absolutely necessary. Examine the trees again in two or three days, then mound earth around them about one-half foot high.

Protection of Trees Against Borers: Protective measures, while they will not insure perfect immunity, will often go far toward preventing the infestation of trees by borers. For this purpose an application of one of the following materials should be made about the middle of June and again the middle of August, to the lower eighteen inches or two feet of the treee: (1) Lime-sulfur Wash. Boil seventeen pounds of sulfur and twenty-two pounds of lime together, in sufficient water to boil one hour, dilute to about twenty-five gallons, and apply; or use Commercial Lime-sulfur, at scale strength, with some free sulfur added. This is especially valuable to prevent Peach-tree borers. (2) Whale Oil Soap, two pounds in one gallon ot water. (3) Ordinary soap, made in a thick solution with water. (4) Wrapping the trees with old newspapers carefully tied about them. (5) Frequent white-washing, with ordinary lime whitewash will aid in preventing them. Care should be taken to cover the trunk completely down to the ground or crown. Remove the earth somewhat, if necessary, at the time of application. Treatment should be made about the middle of June, and repeated about two months thereafter. Note that these are preventive means, and not remedies.

H. A. SURFACE.

DEPARTMENT OF AGRICULTURE—DIVISION OR ZOOLOGY

PEAR BLIGHT

This disease is more commonly noticed when the twigs are making rapid growth during the early part of the season, when the leaves on the affected trees wilt and turn brown, and later black, and remain hanging on the trees. The disease extends from the tip of the twig inward, and finally involves the limbs and the trunk. The same disease may appear on the trunk of larger limbs of trees, and is then often called Body Blight or Canker. Its presence is made known by the roughening and shriveling of the bark. A well defined line of demarkation separates the diseased from the healthy bark.

It infects pear, quince and apple trees, and is known as pear blight, twig blight, black blight, trunk blight, body blight, bark blight, canker, etc.

Treatment: Cut out the diseased twigs and limbs about twelve inches below the diseased tissue. Cut out patches of diseased bark on the trunk or larger limbs. Sterilize all wounds by painting them over with a strong solution of copper sulfate, one pound to one gallon of water, or corosive sublimate, one ounce to one gallon of water, or (best) one ounce of formalin in two gallons of water; or paint the cut surfaces with ordinary house paint.

BLACK KNOT

This is a most common and unsightly fungous disease, which attacks plum and cherry trees. It appears on all woody parts of the tree, but mostly on smaller twigs, first as a slight swelling, and later as a rough, knotty excrescence covering the twig from one to five inches. As soon as this knot forms a complete ring about the twig or limb, the nutriment of the tip portion is completely cut off, and it dies.

Treatment: Cut out and burn all diseased portions, six or eight inches below the knot, in the spring of the year, and all which may develop during the summer. Paint over the cut ends with a disinfectant solution (see under Pear Blight) or house paint. Spray with Bordeaux mixture before the buds burst, using three pounds of copper sulfate, five pounds of lime and fifty gallons of water, or with lime-sulfur solution as for San José scale, and follow this with a spray of Bordeaux mixture made by using one-half the above quantity of copper sulfate, as soon as the petals drop, and again ten days or two weeks thereafter.

PEACH YELLOWS

The condition known as Yellows is probably the most serious affection of the peach and plum. That it is contagious, spreading in all directions from a focus, is well established. For this reason curative measures are not generally recommended. Affected trees should be removed and destroyed, care being taken to avoid bringing them in contact with healthy trees, as soon as the first definite symptoms of this condition appears.

The first certain sign of the disease is premature ripening of fruits, which are more or less mottled with red on the outside, and streaked with red within. The sign next in importance in determining the Yellows is the modification of the twig and leaf growth. The leaves of diseased trees will be shorter, narrower, slightly yellow in color, and standing at right angles to the tree. Suckers often grow in the axils of the leaves, which are set more closely together on the twigs than normally.

The most conspicuous symptom of Yellows is the thick clusters of fine twigs, containing small, red and yellow leaves, closely set, which grow on the large limbs and trunks of the trees. Such trees bear, if at all, small, premature, bitter, worthless fruit, and nothing is gained in keeping them on the premises, but they serve as a source of infection for the entire neighborhood. The sooner they are removed the better it will be for the other peach and plum trees.

H. A. SURFACE.

DEPARTMENT OF AGRICULTURE—DIVISION OF ZOOLOGY

THE CODLING MOTH

This insect is responsible for more damage to pome fruits,—apple, pear and quince,—than probably any other pest. The injury is done by the larva or "worm" feeding inside the fruits around the seed capsule. This causes them to drop from the tree prematurely as a rule, and such infested fruits as remain hanging until ripe are exposed to rots, and are unfit for market.

The adult female moth is a beautiful little brown and gray insect. These first issue from the pupae in the spring, about the time of the blossoming of the apple, and the eggs are laid singly upon the leaves and young fruits. From these hatch, within ten days, yellow colored larvae, which generally crawl to the calyx or blossom end of the fruits, feeding sparingly on the way, and there eat their way in. When full grown, these larvae burrow out through the side of the fruits, and seek a protected location, as beneath the scales of bark on the larger limbs and trunk of the tree, where they spin cocoons and later pupate. It requires from fifty-five to sixty days from the time of egg-laying of the first brood until the eggs of the second brood are laid, which brood infests the half grown fruits in midsummer. The larvae of this brood enter the sides of the fruits, or the cavity or stem end more often than the blossoms end.

Treatment: The method of combating this pest is to spray the trees with arsenicals. Mix two pounds of arsenate of lead (paste or dry) in fifty gallons of water, and apply immediately after the blossoms fall, in a course spray, from a nozzle held slightly above the blossoms, directed downwards as much as possible, and thrown with considerable force, so as to drive the poison in the open calyces of the erect fruits. This can be facilitated by using a nozzle of the "Bordeaux" type, connected with an elbow or "crook" to the extension rod, and a strong pump so that a pressure of over 100 pounds to the square inch can be maintained. Apply a second spray a week or ten days after the first. In this second spray the arsenate of lead should be mixed in Bordeaux mixture, or dilute Lime-sulfur Solution, if fungus troubles are anticipated.

We now make the general recommendation used for the second spray on all bearing apple, pear and quince trees, one gallon and one quart of strong concentrated Lime-sulfur Solution (either commercial or home-boiled) in fifty-nine gallons of water, and to this add two pounds of arsenate of lead.

CANKER WORMS

Canker worms (measuring worms, span worms or loopers) are leaf-eating insects of the most destructive kind, attacking fruit trees early in the spring, while the leaves are small. The adult males are thin-winged moths, expanding about an inch. The females are wingless, and crawl up the tree, laying their eggs under shreds of barks, around twigs, or on expanding buds. The hatching of the eggs covers a period of several weeks.

Treatment: Spray infested trees with arsenate of lead, as for curculio or codling moth just as soon as the young worms appear. Trees can be protected by applying about the trunk a bandage of tar, printer's ink, sticky fly-paper, wool or loose cotton, very early in the spring (February) thus preventing the ascent of the female moth.

H. A. SURFACE.

CURCULIOS

The Curculios are Snout Beetles or "Bill Bugs,"—so named from the long snout. There are several species of curculios, and they attack apple, pear, quince, peach, plum, apricots, cherry and nectarines, while others attack nuts, acorns, and various parts of growing plants. The most injurious of these is the Plum Curculio, so called because it was believed to infest only the plum. These insects are grayish black "snout beetles" or weevils, measuring about one-fifth inch in length, and bearing several bumps on their back. The beetles spend the winter concealed about the orchard beneath the rough bark, or under rubbish. They emerge from their hiding place following the blooming of the fruit trees, and soon begin to feed upon the young leaves and fruit, upon the latter of which they make their characteristic punctures. Two kinds of injuries are made, the round holes into which the eggs are deposited by the female, with the crescent shaped cut beneath, and the crescent cut alone, which indicates a feeding puncture. Peaches, plums and cherries are first attacked, while apples are stung when the size of a pea or larger.

The eggs hatch within ten days, into a tiny, yellowish-white, legless grub with a brown head, which bores minute irregular channels toward the core of pome fruits, but feeds about the pit in stone fruits. After from three to five weeks the larvae leave the fruits, and pupate in an earthen cell about two inches beneath the surface of the ground, maturing during mid-summer. There is but one brood each season. While a few of the curculio eggs deposited in the apple ever hatch, and less larvae come to maturity, the injury to the fruits from egg-laying and feeding punctures causes knots and gnarls, and thus damages the appearance and reduces the market value of the crop.

Treatment: There are two methods of treatment available. Owing to the habit of these insects to feign death when disturbed, they can be jarred from the tree in the early morning upon sheets spread beneath it and gathered and destroyed; but the better method is to

spray with arsenate of lead paste, mixed in water, at the rate of two pounds to fifty gallons, as soon as the petals have fallen from the trees, the same as for the codling moth. A second and third spray should be applied at intervals of ten days or two weeks.

Summer cultivation also lessens the number of these pests by destroying them in their earthen cells. All wormy and fallen fruits should be destroyed promptly.

Since the codling moth and curculio are found upon the same trees at much the same time, the treatment for codling moth supplemented with one additional spray ten days or two weeks after the second, is found effective in also controlling the curculios.

H. A. SURFACE.

THE TENT CATERPILLAR

The American Tent-caterpillar, also called the Apple-tree Tent-caterpillar, is usually found infesting apple and wild cherry trees, although when these trees have been stripped of their foliage they will feed upon the leaves of peach, plum, maple, elm, poplar, willow, and other fruit and shade trees and bushes.

The eggs are deposited in June or July by stout, hairy, brownish or buff-colored moths on the twigs in bands or cylindrical masses, and covered with a glutinous secretion, which soon hardens and protects them. About the time the buds open in the spring the young caterpillars eat their way out of the egg cases, and begin to feed upon the foliage. In a few days they begin to build their white "tents" in the forks or crotches of the limbs, to which they retire for rest and protection from the weather. They leave a trail of silk behind them while traveling about in search of food, and twigs near the tent become covered with a dense mat of web.

The larvae feed greedily for six or seven weeks, attaining a length of about two inches. Pupation occurs in the tent, or on the trunk and large limbs of the tree, or in rubbish around the tree.

Treatment: Cut off and destroy the egg masses before the foliage appears. Remove and burn the "tents" while still small. Cut down all large wild cherry trees near the orchard, and treat small ones. Spray trees about the time the caterpillars begin to feed with 2 pounds of arsenate of lead mixed in 50 gallons of water. Do not burn the tents while in the trees, as the branches are injured by the heat. Some persons shoot them away with shot guns loaded with powder and paper only. Others remove them with bristle brushes on the ends of poles.

BUD MOTH

This very small, dark, ashen-gray moth lays its eggs during midsummer, and from these hatch small brownish caterpillars, which pass the winter encased in tubes made from the rolled up half of a leaf. From this they emerge, about half grown, in early spring when the buds are beginning to swell, and eat their way into the

bud, thus destroying it. Their work can be recognized by the irregular growth of the branches, caused by the injury to the terminal buds.

Treatment: (a) Gather all the leaves from under the infested trees in the fall and burn them. (b) Spray infested trees in the early spring, as soon as the caterpillars make their appearance, or when the buds are bursting, with 2 pounds of arsenate of lead mixed in 50 galons of water.

DEPARTMENT OF AGRICULTURE—DIVISION OF ZOOLOGY
APHIDS OR PLANT LICE

These are soft-bodied, sucking insects about one-eighth inch in length. They pierce the tissues of the young shoots and under side of leaves of trees and plants, inserting their beaks or bills for the purpose of sucking out the sap. This injury often causes the leaves to curl in a characteristic manner.

There are a number of species of Aphids, some passing their entire life upon a singe host plant, while others spend part of the year on other plants. Because of the "honey dew" secreted by these insects, they are admost invariably accompanied by ants which feed upon this liquid.

The eggs of the Aphids are often deposited upon the smaller twigs of trees and upon plants late in the fall, by fertilized, egg-laying females, in which stage the winter is passed. From these eggs hatch, usually in the early spring, agamic females which become the mothers of numerous offspring, bringing forth their young alive. After several generations of wingless forms or upon crowding winged Aphids, are produced, and these migrate to other localities and start new colonies. In midsummer they go from the apple leaves to roots of grasses, and return in the fall. Egg-laying forms are produced only in the fall.

Aphids are usually very destructive to plant life, and all trees and plants should be sprayed thoroughly as soon as they are found to be infested. The Green Apple Aphis; the Rosy Apple Aphis; the Cherry-tree Aphis; the Maple Aphis; the Peach-tree Aphis; the Rose Aphis; the Cabbage Aphis; the European Grain Aphis; infesting respectively the plants indicated by their names, are the most common species in this State.

Treatment: (a) Dormant Spray. The exposed eggs of Aphids upon trees can readily be destroyed by spraying with lime-sulfur solution, as for San José scale, just before the buds burst in the early spring, using either the Home-boiled or Commercial Concentrated Lime-sulfur Solution. Fruit trees infested with San José scale and Aphids should be sprayed with either one of the following:

Lime-sulfur Solution (Home-boiled, Concentrated). Slake 60 pounds of high grade lime, adding 125 pounds of fine sulfur previously mixed to a paste with water (to break up any lumps which may be present), and boil in 50 gallons of water for one hour. If necessary, add water to make up for any evaporation; strain and store in closed vessels until needed, or store in open vessels, keeping the

soution covered with a thin film of oil. When ready to spray on dormant trees or shrubs dilute one part with seven or eight parts of water, or to specific gravity, as shown by the Hydromter test of 1.04 to 1.03.

Lime-sulfur Solution (Commercial, Concentrated). Many manufacturers are placing upon the market ready-made Concentrated Lime-sulfur Solutions. These are found satisfactory, and about as effective as the Home-boiled Solution. They should be diluted, as a rule, by adding to one part of the Concentrated Mixture seven or eight of water, or to specific gravity, as shown by the Hydrometer test, of 1.04 to 1.03.

(b) Spring and Summer Spray. Effective work in controlling these insects may be done in the Spring just after they have hatched from the eggs, and are found upon the growing twigs and expanding foliage. As soon as the aphids are seen and before the infested leaves have become curled so as to shield the insects from the spray, apply thoroughly one of the following sprays:

1. Tobacco Decoction, made by steeping ½ pound of tobacco leaves, stems, or dust in 1 gallon of water, slowly raised to a boiling point, then allowed to cool. Continued boiling drives off the nicotine.

2. Kerosene Emulsion. Made by dissolving 1 pound of soap in 1 gallon of hot water, and adding to this 2 gallons of kerosene, stirring and whipping it until it forms a thick creamy mass. To this strong stock soution add seven times its bulk of water.

3. Whale Oil Soap dissolved in water in the proportion of 1 pound to 5 or 6 gallons of water.

4. Common laundry soap or soft soap dissolved in water at the rate of 1 pound to 4 gallons of water.

Pains must be taken to wet completely all parts of the infested plants thoroughly. Should any Plant Lice escape owing to the difficulty of forcing the spray between the unfolding leaves, or into the curled leaves, pick off and destroy the curled leaves, and repeat the treatment as required.

Where one does not have a spray pump at hand aphids can be killed by dashing one of the above solutions over the plants with a whisk broom, or by bending the infested tips of twigs, rose bushes, etc., over and dipping them into a pan containing the solution.

H. A. SURFACE,
Economic Zoologist.

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6. INSPECTION OF IMPORTED PLANTS, SEEDS AND FRUITS

A very important duty of this office has been to inspect importations of plants, seeds and fruits to prevent the ingress of obnoxious insects or plant diseases. Tens of thousands of foreign plants have thus been inspected as soon as they reached the point of destination. It is enough to say that nearly one hundred nests of the justly dreaded Brown-tail moth were found and destroyed during such inspections. This work is mentioned in detail under the heading of Inspection of Nurseries.

In some instances we have been called upon to examine seeds for adulteration, but this work belongs properly to a botanist, and we forward them to Dr. W. A. Buckhout, of The Pennsylvania State College, where we always find efficient, prompt and courteous aid.

7. MAKING COLLECTIONS

While but comparatively little effort has been given to making collections of insects, we have not been unmindful of the importance of collections, properly made, classified and preserved. All specimens sent to this office by contributors have been named as far as possible, and also acknowledged to senders, with such information as was requested concerning them. During the year the office received the following accessions to the museum collection:

Insects,	1096
Invertebrates, not Insects,	79
Reptiles and Batrachians,	30
Birds and Mammals,	14
Fish	1
Total	1220

This does not give the number of specimens received during the year, as some of these accessions consist of at least one hundred specimens.

In addition to the above, thousands of specimens were collected by our direct representatives, and as these were in better condition than are those which are, as a rule, sent through the mail, they were preserved in the Department Collection.

This Collection has now come to be one of the most famous in the country for the excellent condition of specimens, the great number collected in so short time, and the full and accurate data preserved therewith. While it consists chiefly of insects, yet it contains most of the birds of the State, many of the mammals and practically all the reptiles and amphibians. No book on the Entomology of Pennsylvania will be complete without the data contained in this important Collection.

Breeding Cages. Many insects are sent to us or collected in the immature stages. In fact, it is when in the immature stages that most insects do their more voracious feeding, and some species do all their feeding, and are, consequently, then most destructive. Therefore, we have found it necessary to place them in cages, known as "breeding cages," in order to keep them alive until their various changes have been undergone or transformation is completed, and their adult stage is reached.

Thus the insect can be recognized in its different stages, adult specimen is obtained in good condition, and the full life history ascertained.

About one hundred and fifty breeding cages were thus maintained during the year. It was necessary to see that the specimens were furnished with fresh food and water, and kept properly ventilated, and at the same time properly closed, to provide against the escape of the occupants. Breeding cage work is of the utmost importance.

The great difficulty at present is, that we do not have a room of natural or normal climatic conditions (temperature and moisture) in which to keep such specimens and obtain the important data of their natural development outdoors. A most important point to note for an insect is the date of its transformation when in natural surroundings. This gives a clew to the practical remedies to be recommended for its suppression or control. These dates differ in different latitudes and altitudes in a season. The only thing we can do is to work them out for this State in the best manner possible, which we are undertaking, but in this we are seriously handicapped by the lack of a proper room for keeping the cages under normal outdoor conditions. Such a room called an "Insectary," is in use by almost each working entomologist in the country. We trust that a room for insectary purposes wil be furnished very soon by the Board of Public Grounds and Buildings. Its proper place would be as near as possible to the office, in order that a regular attendant may give the cages the attention they need, and make necessary observations.

8. DEMONSTRATIONS

The demonstration work has been by all means the most conspicuous and most important feature of the year for this office. This was prosecuted chiefly by two means: (a) Demonstration Trains and (b) Demonstration Orchards.

(a). Demonstration Trains. In 1910 the Pennsylvania and Cumberland Valley Railroads again offered to equip and run trains for demonstration purposes over their lines. We consequently gave one week to the demonstration work on the Cumberland Valley, and followed it immediately with two weeks on the Pennsylvania Railroad.

From the beginning the newspapers gave full and commendable notices of the work, and the crowds of visitors increased in size and interest until toward the end of the tour the train of two full-sized passenger cars was entirely inadequate to hold them, and it was necessary to conduct three or four meetings simultaneously, in order to instruct all who came to any one station. The attendance during this period numbered about ten thousand, and the interest was greater than on any previous tour.

Several booklets on Orcharding, written by the Economic Zoologist, at the request of Mr. W. J. Rose, of the Pennsylvania Railroad Company, were printed and distributed by the Railroad, and the public seems to find much interest in the plan of small, condensed and convenient booklets, which can be carried in the pocket, and consulted when needed. It became necessary to issue a second edition, which was revised by the writer.

At all times some of the officers, especially Division Freight Agents and their representatives of the railroad companies, were with us, and were successful in their efforts to render every possible aid to make the tour profitable to the agricultural people. These Demonstration Trains had much to do with the increased interest in orcharding which has sprung up and is making itself manifest by the better care of the orchards and increased planting. Our thanks are due to the railroad companies for this valued and efficient co-operation.

(b). Model Orchards. The demonstrations in the orchards were for the purposes of giving individual assistance to some orchard growers here and there, and also to instruct as many people as possible in each of several communities. For the purpose of reaching as many visitors as possible, we established what are now known as Demonstration Orchards, with from one to seven in each county. The average number per county was three or four.

This was the continuation of last year's demonstration orchard methods, but we changed from the plan of using orchards in public institutions to that of making use of orchards of private ownership. We have found this much to be preferred, because the private orchard owners have their orchards more under their own care, than has the care-taker at a public institution, who is not confronted by the important need of personal gain coming from carefully and correctly following what is recommended.

The Demonstration Orchards became so popular, and the demand for them so great that we could not reach one-fourth of those which were offered, and which we were desirous of accepting. It became apparent that the owners of the other orchards should have the service of this office as far as possible, and to give this we established what were further known as Supervision Orchards.

In each of the Demonstration Orchards there were public meetings three times during the year, showing how to prune, spray, and otherwise conduct orchard operations. In the Supervision Orchards our inspectors or demonstrators gave personal service to the owners and such visitors as came, without attempting to give public demonstrations of these methods.

SUMMARY MODEL ORCHARDS

A summary of the work in the Demonstration Orchards is as follows:

Counties	Number demonstration orchards	Number of trees in demonstration orchards	Public meetings in demonstration orchards.
Adams,	3	4,458	7
Allegheny,	5	2,130	11
Armstrong,	4	2,567	9
Beaver,	4	1,937	9
Bedford,	5	4,883	11
Berks,	7	1,637	16
Blair,	4	1,230	9
Bradford,	6	2,275	13
Bucks,	5	656	11
Butler,	4	7,579	9
Cambria,	3	705	7
Cameron,	2	1,080	5
Carbon,	3	1,079	7
Centre,	5	3,289	12
Chester,	3	273	8
Clarion,	3	2,170	7
Clearfield,	3	1,024	7
Clinton,	2	1,063	6
Columbia,	5	735	11
Crawford,	2	237	4
Cumberland,	4	65	9
Dauphin,	3	522	7
Delaware	3	2,107	8
Elk,	2	563	4
Erie,	5	2,833	11
Fayette,	1	49	3
Forest,	2	118	5
Franklin,	4	454	9
Fulton,	2	5,025	5
Greene,	3	1,145	7
Huntingdon,	3	632	7
Indiana,	4	1,749	9
Jefferson,	3	222	7
Juniata,	3	250	7
Lackawanna,	5	2,982	11
Lancaster,	5	1,236	11
Lawrence,	2	844	5
Lebanon,	4	891	9
Lehigh,	3	2,727	7
Luzerne,	5	24,931	12
Lycoming,	6	2,585	13
McKean,	3	449	7
Mercer,	4	608	9
Mifflin,	4	1,015	9
Monroe,	3	2,340	7
Montgomery,	7	2,602	15
Montour,	2	325	5
Northampton,	3	3,374	7
Northumberland,	6	1,484	14
Perry,	4	1,655	10
Philadelphia,	2	675	4
Pike,	2	442	5
Potter,	3	584	7
Schuylkill,	6	2,690	13
Snyder,	3	4,309	7
Somerset,	4	514	9
Sullivan,	3	2,593	7
Susquehanna,	2	75	5
Tioga,	6	1,055	13
Union,	3	8,736	7
Venango,	3	680	7
Warren,	2	1,236	5
Washington,	4	668	9
Wayne,	4	4,411	9
Westmoreland,	5	4,324	11
Wyoming,	4	2,862	10
York,	5	3,701	11
Total,	247	151,286	567

9—7—1910

SUMMARY SUPERVISION ORCHARDS

A summary of the work done in the Supervision Orchards in the year 1910 is as follows:

Counties	Number of supervision orchards	Number of trees in supervisionn orchards	Days work in and visits to supervision orchards
Adams,	37	24,778	77
Allegheny,	29	16,822	63
Armstrong,	12	3,107	28
Beaver,	11	7,033	26
Bedford,	15	10,489	35
Berks,	25	9,110	57
Blair,	14	8,088	32
Bradford,	34	6,678	74
Bucks,	52	16,601	109
Butler,	19	7,347	42
Cambria,	9	1,091	21
Cameron,	3	285	8
Carbon,	4	3,083	11
Centre,	24	15,061	53
Chester,	26	9,100	55
Clarion,	12	5,704	27
Clearfield,	4	6,545	11
Clinton,	5	2,049	12
Columbia,	15	4,512	35
Crawford,	9	2,138	20
Cumberland,	9	7,266	22
Dauphin,	13	2,620	29
Delaware,	8	1,055	19
Elk,	1	88	4
Erie,	17	8,756	39
Fayette,	6	6,884	13
Forest,	2	430	6
Franklin,	15	49,448	34
Fulton,	2	2,334	6
Greene,	7	2,651	17
Huntingdon,	11	32,574	25
Indiana,	18	7,878	40
Jefferson,	26	12,890	55
Juniata,	8	742	19
Lackawanna,	11	2,469	27
Lancaster,	40	12,726	85
Lawrence,	12	3,680	26
Lebanon,	22	3,862	48
Lehigh,	8	1,359	19
Luzerne,	15	11,357	35
Lycoming,	13	2,244	32
McKean,	1	282	5
Mercer,	16	8,068	36
Mifflin,	5	914	14
Monroe,	6	3,908	15
Montgomery,	14	5,931	35
Montour,	7	1,090	16
Northampton,	16	5,771	35
Northumberland,	21	13,926	48
Perry,	18	8,575	40
Philadelphia,	5	411	12
Pike,	2	1,020	6
Potter,	12	2,239	27
Schuylkill,	17	5,283	40
Snyder,	11	9,555	25
Somerset,	3	2,821	10
Sullivan,	1	150	5
Susquehanna,	23	8,596	48
Tioga,	30	5,295	66
Union,	8	12,840	19
Venango,	10	2,038	23
Warren,	8	2,796	18
Washington,	22	8,700	48
Wayne,	18	8,055	40
Westmoreland,	15	6,498	35
Wyoming,	25	11,007	54
York,	38	23,991	81
Total,	975	493,364	2,197

It is almost incredible to think that in addition to the immense amount of work of the inspection of nurseries and imported nursery stock, and the inspection of one and one-third million fruit trees belonging to private individuals, the work was carried successfully through the year in two hundred and forty-seven Model Demonstration Orchards, containing one hundred and fifty-one thousand, two hundred and eighty-six trees, in five hundred and sixty-seven public meetings. In addition to this there were nearly one thousand Supervision Orchards, containing four hundred and ninety-three thousand, three hundred and sixty-four trees,—reaching a total of two hundred and ninety-seven days' work given by our demonstrators to the latter.

As to the success of this work, or actual results in the orchards, the following statements partially attest:

ABSTRACTS OF LETTERS

Wyoming County. Tunkhannock, Pa.

* * * "We have had hundreds of people here this summer to see our orchard, and everyone said that the improvement made in it in one season is wonderful. We have a fine lot of apples, plums, pears and peaches."

W. C. ALLEN.

Bucks County. New Britain, Pa.

* * * "This work was one of the most interesting and instructive demonstrations ever seen by us, and Dr. Washburn, Superintendent McKay and myself appreciated the work done by the demonstrator."

DR. FRED. E. BRISTOW.

Mifflin County. Lewistown, Pa.

* * * "Please accept my sincere thanks for the very profitable and pleasing demonstration held at my orchard on the 8th and 9th. Your assistant was very thorough, patient, and obliging, and it was a great pleasure to have him with us, It is a very great embarassment to me that the people did not appreciate the trouble that has been taken, and perhaps in advertising the next exhibition, if it was stated that the public would not be admitted, the fences would be hanging full of people."

WILLIAM P. WOODS.

Montgomery County. Dresher, Pa.

* * * "I desire to thank you for sending to my farm yesterday such an affable and learned representative. I knew I did not know much about pruning fruit trees, but after he was with me awhile

I realized how much less than nothing I really did know. He is certainly a past master at instructing. Every cut was thoroughly explained, and after a certain number of trees were pruned he allowed me to direct the pruning while he did the actual cutting, in order to see if his instructions had been heeded. After this he told me to take a tree and prune it, while he looked on. After two or three trees had been pruned I seemed to catch his idea, and toward the last I was pronounced as near perfect as a novice could be. I do not know when I learned so much in such a short time. I was sorry to see him leave, and I trust you will let him come again at the very earliest opportunity. He seems to think that my orchard has a future, both by its location and its condition, and owing to its being not yet in bearing is in just such shape as is best suitable for the experimental work which you have undertaken. I am more enthusiastic than ever over the matter, and you cannot send your men to me too often. I wish you could come yourself sometime. I would like to meet you, and also show you my embryo orchard."

F. D. MAWHINNEY.

Bradford County. Ulster, Pa.

* * * "Our orchard has responded splendidly to the treatment your thorough and efficient representatives have given it. We are delighted with the results, and would be most pleased to be able to tell you so in person at the meeting on Oct. 4th. We are near the Station, and would be so grateful for your helpful presence. The demonstrator is greatly pleased at our fruit prospects. He is doing such good conscientious work in our territory that I hope the people interested in fruit culture will turn out well, and see the good results of spraying, etc. in our orchard. Our fruit is convincing evidence, and in case I do not see you I wish to express my appreciation for your great work, and for the help you have been to us in helping us save our trees and make them profitable to us."

MRS. CAROLINE REYNDERS.

Dauphin County. Dauphin, Pa.

* * * "With your help I have learned how to control scale and codling moth, and now have purchased 50 acres of ground to raise fruit."

WILLIAM MINSKER.

Lancaster County. New Holland, Pa.

* * * "I must say I derived a vast lot of benefit from your representative in following his instructions, etc. Also, was greatly interested in the information given me in various lines which has helped me considerably."

JONATHAN B. FISHER.

Mercer County. Jackson Centre, Pa.

* * * "We are much pleased with the extra expense added to our orchard during the spring and summer. The mulching, pruning and spraying has given us the finest lot of Baldwin apples, and the nearest perfection that we ever had on the farm."

U. G. STERRETT.

McKean County. Smethport, Pa.

* * * "My orchard shows the work of your representatives last spring. The trees which were sprayed are hanging full of fine apples, while those trees which were not sprayed have very few apples of a very inferior quality.

"The inspector who superintended the trimming of the trees and the first spraying with lime and sulphur, and who has been examining the orchards in this vicinity for the past few weeks, appears to be a very competent and trust-worthy young man. I cannot speak in too high terms of his gentlemanly behavior and painstaking manner in giving instructions in trimming and caring for trees. He never loses his temper, and is very deliberate and careful, and still very convincing in his manner of giving instructions, etc."

D. C. YOUNG.

Franklin County. Milnor, Pa.

* * * "I want to thank you for all of the good, clean and kind instruction I received in the past year, and hope you will continue to keep right at it through the 1911 season. I am glad that I have been of some help to your course of good work, which is so much needed in these parts."

J. R. WHITMORE.

Bucks County. Taylorsville, Pa.

* * * "I wish to take this opportunity of informing you that the results from spraying, and other up-to-date methods of tree culture learned from your Department, have been highly satisfactory. In former years I have had very small and inferior crops, which would not stay on trees to maturity. This year had over three hundred bushels from three acres; apples were fair size, shape and color, very few windfalls, and trees were in much better shape to go through the winter than ever before."

EDWIN A. CARPENTER.

Centre County. State College, Pa.

* * * "Your inspector knows his business, and is a nice man. He got here Monday noon. We had quite a crowd, and they all seemed greatly interested in the work. Three parties came from

Stormsburg, two of them stayed all night and until Tuesday 4 o'clock. The demonstration was a great advantage to me. The people that were here were all pleased with the work. All that spites me was that there was not another man along. We would have gotten over more of the orchard, but I am satisfied with the amount we did do."

N. C. NEIDIGH.

Lancaster County. Lancaster, Pa.

* * * "I have always taken a great interest in your efforts to exterminate all tree parasites, and watch for your Bulletin for much useful information in my work as a Commercial Sprayer. I believe you are doing a great work for the citizens of this State, and a few years from now will see this the banner fruit State."

J. C. WILMUTH.

Philadelphia County. Frankford, Pa.

* * * "I am glad to say that I forget what the San José scale looks like, after using your Lime-sulfur Solution about three years ago."

WILLIAM B. FARRELL.

Allegheny County. Library, Pa.

* * * "Some time in February we had one of your men here and spend a day with us, showing how to prune and telling of the different insects and pests that destroy our fruit. I had quite a number of the neighbors in, and all seemed very much interested in his lecture and mode of treating the trees. We had our Power Sprayer in operation, and had quite a display in general. I feel very grateful for the day's meeting, and also feel that I have been benefitted."

R. J. WILSON.

Elk County. DeYoung, Pa.

* * * "As soon as we arrived at the farm, the demonstrator started the work at once (although it was raining quite hard) in trimming and cutting back of the trees, at the same time giving us instructions in the care of an orchard. I do not know when I have spent a day that was so interesting and instructive, and everyone there was very much interested, and they stated to me later that they were very much pleased with the work. As we came back to Spartansburg I saw people and stated to them what we had been doing. They said they were sorry that they did not learn about this work being done, as they woud have surely been there. I believe that we have gotten an interest started in that section, and if we can only arrange to keep the work moving that it will terminate in a great benefit to the people in that vicinity."

W. N. FULLER.

Armstrong County. Dayton, Pa.

* * * "In regard to our success I am much pleased with the orchard, and expect one year more will make much better improvements. I have had some neighbors visit the orchard, but not many. When I put those apples on exhibition at the Dayton Fair, that is when they commenced to look. Nine entries of sprayed apples and eight red cards, which meant first premiums. I will have one hundred and fifty bushels of good winter apples. I think I can do much better in the future, for I think I can handle the chemicals much better. Everybody that was present when your inspector was here was well pleased with his work."

T. W. NEIL.

Moorestown, N. J.

* * * "Am sure your plan of inspecting orchards, advising growers and showing them what to do, and how to do it, will be of vest benefit in promoting profitable fruit growing."

W. J. SAWYER.

The demand for the supervision work from growers has greatly increased recently.

SUMMARY

Number of letters written and copied 7732.
Number of accessions to collection 1220.
Number of nurseries inspected 196.
Number of acres inspected 3,408.

Orchard Inspection:

Number of apple trees inspected	896,312
Number of pear trees inspected	94,450
Number of peach trees inspected	238,635
Number of plum trees inspected	81,085
Number of cherry trees inspected	65,380
Number of quince trees inspected	422
Total number of trees inspected	1,380,892

Model Orchards:

Number of Demonstration Orchards 247.
Number of trees in Demonstration Orchards 151,286.
Number of public meetings in Demonstration Orchards 567.
Number of Supervision Orchards 975.
Number of trees in Supervision Orchards 493,364.
Number of days' work in Supervision Orchards 2,197.

Respectfully submitted,

H. A. SURFACE,

Economic Zoologist.

REPORT OF THE STATE VETERINARIAN

Harrisburg, Pa., *January 1, 1911.*

Hon. N. B. Critchfield, Secretary of Agriculture.

Dear Sir:—I have the honor to submit the following report upon the work of the State Veterinarian, as well as upon the work of the office of the State Livestock Sanitary Board for the year 1910.

During this year the State Livestock Sanitary Board has not had to cope with any extensive outbreak of a highly contagious disease. The work has principally been along the line of enforcing the rules and regulations previously adopted by the Board. My experience during the year has led me to believe that the breeders, dairymen and farmers are becoming more acquainted with the laws pertaining to the repression of infectious diseases and are more willing to co-operate with the State Livestock Sanitary Board, in the measures adopted by them.

Reports from the agents of the Meat Hygiene Service show that the butchers are beginning to realize the importance of slaughtering animals under sanitary conditions. It has only been necessary to call their attention to the defects connected with the construction of their slaughter houses, method of dressing the carcasses, disposal of offal, etc., and they would willingly correct the same.

The work of the experimental farm has progressed satisfactorily. The production of a serum for the prevention of hog cholera has been one of the main features. Every outbreak of hog cholera that has been reported to the State Livestock Sanitary Board has been thoroughly investigated and the non-infected animals vaccinated. In this way thousands of animals have been saved. It is almost impossible to measure their value in dollars and cents. In one herd where a number of animals had died of hog cholera, the remaining number, over 800, were vaccinated with gratifying results. Another important part of the work at the farm was the continuation of the experiments with the view of producing a practical method of immunizing young animals against tuberculosis. It is proposed during the next year to issue an elaborate report upon this subject, the experiments of which have covered a period of more than eight years. After it was discovered that it was possible to produce an immunity in young animals, the results of which were published by Dr. Leonard Pearson and Dr. S. H. Gilliland, some years ago, it remained then to determine the size and number of doses to produce a serviceable degree of immunity, the duration of such immunity, the effect upon the animal as it matured, and if it would be possible to rear a tuberculosis free herd from a tuberculous herd.

The State Livestock Sanitary Board and the experimental work of the farm suffered a great loss in the resignation of Dr. E. S. Deubler, which took place in November on account of ill health. Dr. Deubler had been in charge of the work of the farm for over three years and was familiar with every phase of the experiments in progress and made great sacrifices to see that the same were properly carried out.

The work of the laboratory has materially increased during the past year. It appears that the veterinarians throughout the State have come to realize the assistance the laboratory can give them in making diagnoses of their cases, especially those that are suspected of being of an infectious or contagious nature. A complete report of the work of the laboratory will follow.

THE MEAT HYGIENE SERVICE

The agents of the Meat Hygiene Service have worked arduously in the territories assigned to them. Their work has consisted principally in the re-inspection of slaughter houses and of giving advice to those who proposed the erection of new buildings to be used for the slaughtering of animals for food purposes.

Owing to the outbreak of foot-and-mouth disease the previous year, it was not possible for the agents to visit the slaughtering and rendering plants in their territories as often as desired. This year they have been able to give their undivided attention to the work of inspecting meat and all by-products that are to be used for food, as well as to give instructions as to the manner in which animals shall be killed and the disposal of the offal. In nearly all territories each slaughtering house has been inspected at least twice and sometimes three and four times with a few exceptions. During the summer months when the flies were abundant, attention was paid to meat markets in order to insist upon the owner keeping all meat well covered. The greatest difficulty encountered along this line was in market houses where the meat was exposed for a period of four to five hours in the morning; the owner claiming that if he was forced to cover up his meat that it would be impossible for him to obtain new trade inasmuch as customers could not see the character of the meat he had to offer.

Attention has also been paid to the inspection of carcasses of animals that have been killed which were previously not considered to be tuberculous, but afterwards found to be diseased to such an extent as to render their meat and by-products unfit for food purposes.

The folowing table will give an illustration of the number of meat markets and slaughter houses inspected during the year:

MEAT MARKETS

County	Number of meat markets examined	Number defective on first examination	Number defective on second examination	Number defective on third examination	Number defective on fourth examination
Adams,	20	6	2	0	0
Allegheny (a),	9	1	0	0	0
Armstrong,	9	1	0	0	0
Beaver,	0	0	0	0	0
Bedford,	0	0	0	0	0
Blair,	73	0	0	0	0
Berks,	41	1	0	0	0
Bradford,	16	1	0	0	0
Butler,	0	0	0	0	0
Bucks,	48	0	0	0	0

MEAT MARKETS—Continued

County	Number of meat markets examined	Number defective on first examination	Number defective on second examination	Number defective on third examination	Number defective on fourth examination
Cambria,	102	0	0	0	0
Cameron,	17	0	0	0	0
Carbon,	0	0	0	0	0
Centre,	36	2	0	0	0
Chester,	48	6	1	0	0
Clarion,	12	2	0	0	0
Clearfield,	66	0	0	0	0
Clinton,	18	0	0	0	0
Columbia,	54	4	0	0	0
Crawford,	25	1	0	0	0
Cumberland,	56	30	0	0	0
Dauphin,	152	19	0	0	0
Delaware,	43	5	1	1	0
Elk,	38	2	0	0	0
Erie,	3	0	0	0	0
Fayette,	0	0	0	0	0
Forrest,	2	0	0	0	0
Franklin,	43	10	4	0	0
Fulton,	0	0	0	0	0
Greene,	1	0	0	0	0
Huntingdon,	13	1	1	0	0
Indiana,	11	0	0	0	0
Juniata,	12	0	0	0	0
Jefferson,	30	0	0	0	0
Lackawanna,	150	8	1	0	0
Lancaster,	112	10	0	0	0
Lawrence,	0	0	0	0	0
Lebanon,	53	3	2	0	0
Lehigh,	59	1	0	0	0
Luzerne,	259	9	0	1	0
Lycoming,	99	4	0	0	0
McKean,	35	0	0	0	0
Mercer,	25	6	0	0	0
Mifflin,	8	0	0	0	0
Monroe,	15	1	0	0	0
Montgomery,	20	1	0	0	0
Montour,	9	0	0	0	0
Northumberland,	120	6	2	0	0
Northampton,	119	17	0	0	0
Perry,	2	0	0	0	0
Pike,	2	0	0	0	0
Potter,	14	0	0	0	0
Philadelphia (b),	0	0	0	0	0
Schuylkill,	150	29	3	0	0
Snyder,	23	11	1	0	0
Somerset,	34	10	0	0	0
Sullivan,	8	0	0	0	0
Susquehanna,	25	1	0	0	0
Tioga,	26	0	0	0	0
Union,	14	1	0	0	0
Venango,	43	0	0	0	0
Warren,	21	0	0	0	0
Washington,	0	0	0	0	0
Wayne,	13	0	0	0	0
Wyoming,	14	0	0	0	0
Westomoreland,	0	0	0	0	0
York,	90	11	0	0	0
Total,	2,560	221	18	2	0

a. Meat markets in Allegheny county outside of Pittsburg, the establishments in this city being examined by local inspectors.

b. No general examination was made of meat markets in Philadelphia because there is a force of local inspectors to do the work.

During the year for which this report is made there were 22,932 carcasses examined and passed. Of these 8,662 were beef; 5,482, veal; 3,674, mutton; 5,114, pork. The number of carcasses condemned amounted to 474, of which 278 were beef; 128 were veal; 45 were mutton and 23 were pork. Of these condemned carcasses 60 of them were immature.

SLAUGHTER HOUSES

County	Number of slaughter houses inspected	Number defective on first inspection	Number defective on second inspection	Number defective on third inspection	Number defective on fourth inspection
Adams,	31	13	2	0	0
Allegheny (a),	5	4	0	6	0
Armstrong,	19	5	0	0	0
Bedford,	0	0	0	0	0
Berks,	70	20	2	0	0
Balir,	48	1	0	0	0
Beaver,	11	1	0	0	0
Bradford,	34	3	1	0	0
Butler,	2	0	0	0	0
Bucks,	53	19	0	0	0
Cambria,	41	6	0	0	0
Cameron,	3	0	0	0	0
Carbon,	0	0	0	0	0
Centre,	28	11	1	0	0
Chester,	46	1	1	1	0
Clarion,	6	4	0	0	0
Clearfield,	22	2	0	0	0
Clinton,	16	1	0	0	0
Columbia,	19	10	0	0	0
Crawford,	8	3	0	0	0
Cumberland,	84	37	0	0	0
Dauphin,	104	39	1	0	0
Delaware,	7	3	1	2	2
Elk,	11	4	0	0	0
Erie,	4	0	0	0	0
Fayette,	0	0	0	0	0
Forrest,	0	0	0	0	0
Franklin,	46	16	9	0	0
Fulton,	0	0	0	0	0
Greene,	3	0	0	0	0
Huntingdon,	12	5	0	0	0
Indiana,	8	8	0	0	0
Juniata,	8	1	0	0	0
Jefferson,	6	1	0	0	0
Lackawanna,	23	9	2	0	0
Lancasteer,	183	18	1	1	0
Lawrence,	1	1	0	0	0
Lebanon,	52	12	2	0	0
Lehigh,	40	13	1	0	0
Luzerne,	22	1	0	0	0
Lycoming,	50	4	1	0	0
McKean,	13	4	0	0	0
Mercer,	10	8	0	0	0
Mifflin,	9	0	0	0	0
Monroe,	7	4	1	0	0
Montgomery,	40	18	0	0	0
Montour,	8	1	0	0	0
Northumberland,	55	8	1	0	0
Northampton,	44	9	1	0	0
Perry,	9	0	0	0	0
Pike,	3	0	0	0	0
Potter,	10	0	0	0	0
Philadelphia (b),	0	0	0	0	0
Schuylkill,	35	12	0	0	0
Snyder,	22	3	0	0	0
Somerset,	23	14	0	0	0
Sullivan,	8	5	0	0	0
Susquehanna,	24	7	0	0	0
Tioga,	37	5	0	0	0
Union,	15	3	0	0	0
Venango,	10	1	0	0	0
Warren,	3	1	0	0	0
Washington,	3	1	0	0	0
Wayne,	19	11	0	0	0
Wyoming,	14	5	0	0	0
Westomoreland,	0	0	0	0	0
York,	93	12	0	0	0
Total,	1,641	408	28	4	2

a. Slaughter houses in Allegheny county outside of Pittsburg, the establishments in these cities being examined by local inspectors.

b. No general examination was made of the slaughter houses in Philadelphia because there is a force of local inspectors to do the work.

In concluding my report upon the Meat Hygiene Service, it may be interesting to note that throughout the year there were 2,710 live animals examined at slaughter houses consisting of 1,268 cattle; 383 calves; 178 sheep and 681 hogs. Number of animals quarantined amounted to 383; of which 185 were cattle, 78 were calves and 20 were hogs.

TUBERCULOSIS

The most important work of the State Livestock Sanitary Board during the year consisted in the repression of tuberculosis. This disease is one that is found in every county of the State, though some counties are more free than others. This is well shown in the table which will follow, and upon examining the same it will be found that no applications were received for inspection and application of the tuberculin tests in eleven counties. The fact must not be lost sight of that the tuberculin tests of herds is entirely voluntary on the owner's part and is therefore not compulsory. However, it is within the jurisdiction of the State Livestock Sanitary Board to quarantine and remove any animal or animals afflicted with tuberculosis to such an extent that it can be determined by physical examination.

I find that the average farmer and dairyman are prone to forget after their herd has been tuberculin tested, two essential features, which are the inspection and re-testing of their herds within one year's time and the thorough disinfection of their barns following the initial tuberculin test. I cannot impress too strongly upon the tuberculin testing of every newly purchased animal before the same enters the herd.

During the past year 10,429 animals for dairy purposes have been examined and tuberculin tested. These animals were distributed in 1,079 herds; making an average of between 9 and 10 animals per herd. The number of animals examined physically was 1,893, coming from 235 herds, making an average of between 8 and 9 animals per herd.

Of the 10,429 animals tuberculin tested, 1,525 or 14 per cent. reacted, all of which were disposed of according to the rules and regulations of the State Livestock Sanitary Board. Those examined physically consisting of 1,893 animals, 239 or 12 per cent. were condemned and appraised and destroyed.

It is to be hoped that the next legislature will see fit to grant a larger appropriation for the payment of indemnity for animals afflicted with contagious, dangerous or infectious diseases. In this manner greater progress can be made in detecting and quarantining animals afflicted with tuberculosis. If a badly tuberculous animal is permitted to enter a herd it is capable of destroying 50 per cent. of the value of that herd within one year's time. In conclusion, I beg to state that it is my belief that the suppression of a disease as important as tuberculosis lies in the early detection of an animal afflicted with the disease. In other words, to isolate and quarantine all animals suffering with tuberculosis before they are capable of transmitting the disease or contaminating the stable.

The following table will give a detailed statement by counties of the number of animals examined and condemned during the year 1910:

TUBERCULOSIS

County.	Animals Examined						Total number animals tested and examined	Number condemned on tuberculin test	Number condemned on physical examination	Total number condemned	Percentage (based on number tested and examined)
	State		Owner		Examined Physically						
	Herds	Cattle	Herds	Cattle	Herds	Cattle					
January 1, 1910 to January 1, 1911.											
Adams,	2	40	3	27	7	39	106	23	8	31	28%
Allegheny,	1	1	15	112			113	51		51	45%
Armstrong,					1	3	3		1	1	34%
Beaver,			5	66							
Bedford,					1	13	13		1	1	7%
Berks,	6	150	29	238	8	63	451	93	10	103	23%
Blair,	2	103	1	14			117	31		31	25%
Bradford,			44	432	1	25	457	24		24	5%
Bucks,	12	103	49	275	16	69	447	49	13	62	13%
Butler,	2	9	18	126	2	3	136	25	2	27	19%
Cambria,	4	64	2	22			86	18		18	19%
Carbon,			1	2			2				
Centre,	2	117	3	34	2	1	152	11	1	12	7%
Cameron,			1	7			7				
Chester,	12	208	80	1,033	30	353	1,595	165	34	199	12%
Clarion,	1	2	2	8	2	2	12				
Clearfield,	2	5			3	5	10	1		1	10%
Clinton,					1	2	2		1	1	50%
Columbia,	3	20	10	101	1	13	134	5	1	6	4%
Crawford,	51	916	18	128			1,044	153		153	14%
Cumberland,	4	24	8	84	14	41	149	20	10	30	20%
Dauphin,	6	80	12	199	4	15	214	57	3	60	28%
Delaware,	3	25	36	380			360	99		99	25%
Elk,			1	11			11	4		4	36%
Erie,	5	98	10	91	7	66	255	59	7	66	25%

TUBERCULOSIS

County.	Animals Examined						Total number animals tested and examined	Number condemned on tuberculin test	Number condemned on physical examination	Total number condemned	Percentage (based on number tested and examined)
	State		Owner		Examined Physically						
	Herds	Cattle	Herds	Cattle	Herds	Cattle					
Fayette,			10	52	4	9	61	1	4	5	8%
Franklin,	1	7	7	34	7	40	81		6	6	7%
Fulton,											
Greene,	1	2			1	1	3				
Huntingdon,											
Indiana,	2	11	4	37	3	5	53	7	3	10	19%
Jefferson,	3	12									
Juniata,					2	22	34		2	2	6%
Lackawanna,	2	40	8	80							
Lancaster,	8	44	10	100			120	18		18	15%
Lawrence,			4	49	26	292	436	23	46	69	16%
Lebanon,	7	29	4	7			49	8		8	16%
Lehigh,	2	20	6	168	13	61	117	26	13	39	33%
January 1, 1910 to November 15, 1910.					1	1	189	16	1	17	9%
Luzerne,			13	225	1	6	231	12		12	5%
Lycoming,	2	17	11	71	1	2	90	16	1	17	18%
McKean,	1	33	5	81			114	19		19	16%
Mercer,	1	4	2	16	4	11	31		4	4	12%
Mifflin,			2	3	1	1	4				
Montgomery,	10	394	41	420	6	84	898	119	6	125	13%
Monroe,	3	23	2	38	1	1	62	2	1	3	4%
Montour,	2	29	3	124	1	12	165	24	1	25	15%
Northampton,	5	45	7	43	2	14	102	35	2	37	36%
Northumberland,	4	11	4	30	4	16	57	3	4	7	16%
Perry,			2	56	1	8	64	2	1	3	4%
Philadelphia,	3	60	11	113			173	19		19	11%
Pike,											

Potter,	3	13	1	12	9	93	118	4	9	13	10%
Schuylkill,	1	5	1	1	2	8	14	5	2	7	50%
Snyder,			1	18			18				
Somerset,	1	27			1	3	30		1	1	3%
Susquehanna,	26	500	32	600	4	15	1,115	125	3	138	11%
Sullivan,	1	8			1	1					
Tioga,	2	28	5	52	5	41	121	14	5	19	15%
Union,	1	7			1	9	16	4	1	5	31%
Venango,			9	216	1	1	217	10		10	4%
Warren,	3	184	16	90			274	3		3	1%
Washington,	2	56	8	111	3	2	180		3	3	12%
Wayne,	8	82	4	34			116	14		14	12%
Westmoreland,	3	16	23	151	4	14	188	26	2	28	13%
Wyoming,	3	24	7	101	1	2	127	33	1	34	26%
York,	9	100	27	170	24	111	361	49	25	74	19%

GLANDERS

Glanders appeared in twenty-one counties of the State. There were 64 cases of supposed or suspected glanders reported to the Board. Our records show that 65 stables were examined, including 712 horses, all of which were subjected to a physical examination. There were 35 animals condemned on this examination. In each instance where a supposed case of glanders is reported, all horses that have come in direct contact with the suspected animal are of course subjected to a careful physical examination ,and while the number of horses examined in this way have not always been noted by the veterinarian assigned to these cases, undoubtedly a great number of horses, of which we have no record, have been subjected to a careful physical examination. Philadelphia and Luzerne counties have had the largest number of cases. Suspected outbreaks have been reported in twenty-one counties, but upon careful investigation it was found that seven of the reports were not well founded and the disease did not exist.

The following table will illustrate the distribution of the disease throughout the State as well as the number of cases appearing in the various counties. It will also give an synopsis of the work done upon this disease:

GLANDERS

County	Number of supposed cases reported	Number of stables inspected	Animals examined physically	Animals tested with mallein	Animals condemned on physical examination	Animals condemned on mallein test	Total number of animals condemned
Allegheny,	1	1	12	10		2	2
Berks,	1	1	26	13	1		1
Bucks,	1	1	2	1	1		1
Cumberland,	1	1	1	1		1	1
Erie,	1	1	2	3			
Fayette,	1	1	1	1			
Jefferson,	1	1	1	1			
Lancaster,	2	2	9	7	2	2	4
Lehigh,	1	1	6	5	1		1
Luzerne,	8	8	48	49			
Monroe,	1	1	6	6		1	1
Montgomery,	2	2	30	50	2		3
Northampton,	1	1	1		1		1
Philadelphia,	26	29	511	522	24	12	36
Potter,	3	3	7	6	1	1	2
Schuylkill,	1	1	7	7		3	3
Susquehanna,	1	1	17	17		1	1
Tioga,	3	3	15	13			
Washington,	1	1	1	1			
Wyoming,	1	1	1	1			
York,	4	4	8	7	1		1

HOG CHOLERA

The disease—hog cholera—was for many years a terror to hog raisers. However, since the discovery of a serum for the prevention of the disease by Dorset of the Bureau of Animal Industry, it has

been possible to place hog raising on a more profitable basis. The State Livestock Sanitary Board during the year 1910 investigated and vaccinated the non-infected hogs in every outbreak that was reported to them. Eighty outbreaks were reported, though upon investigation, one of these was found not to be hog cholera. In these eighty herds, 2,137 hogs were exposed; 848 were sick and 896 died. It has been the policy which is founded upon well recognized authority not to vaccinate hogs that were sick, and, therefore, the 848 reported sick were not vaccinated and only those exposed and which showed no evidence of disease were inoculated with the serum. The following table will give a detailed report of the various outbreaks showing the number of herds investigated, number of hogs exposed, the number of hogs sick and the number of hogs dead.

During the period between January 1, 1910 and November 15, 1910, seven cases where hogs were dying, supposed to be affected with hog cholera, were brought to the attention of the State Livestock Sanitary Board, but it was found upon examination in these seven instances that the animals were not afflicted with hog cholera. In some cases the animals died as a result of having been fed refuse from hotel kitchens that contained a greater quantity of dishwater in which was found partially dissolved soap powder, that caused a gastro intestinal catarrh. In other instances green corn caused indigestion:

HOG CHOLERA

County	Herds	Number of exposed hogs	Number sick	Number dead
Allegheny,	1	4	4	2
Berks,	1	7	1	1
Bucks,	1	29	5	3
Carbon,	1	27	1	1
Chester,	3	56	33	30
Cumberland,	13	356	43	68
Dauphin,	1	71		
Delaware,	3	4	3	18
Franklin,	9	186	15	101
Jefferson,	3	13	10	7
Lancaster,	4	108	56	46
Lehigh,	2	20	5	3
Luzerne,	1	75	15	6
Lycoming,	2	42	32	30
McKean,	2	60	49	27
Montgomery,	2	510	170	169
Northampton,	1	16	4	8
Perry,	11	224	155	159
Somerset,	3	20	5	3
York,	16	309	242	214

RABIES

The disease known as rabies or hydrophobia, has been quite prevalent throughout the State during the past year, it having appeared in forty-four of the counties. Only through the strict quarantine of all dogs that have been bitten or have been exposed to the disease have we been able to hold it in check. In many instances it was necessary to place general quarantines on townships, boroughs and counties. In many instances these quarantines were wilfully violated by no one claiming ownership to the dog at large, and it was therefore necessary for the State Livestock Board to enforce these quarantines by placing a man in the district quarantined and authorizing him to shoot all dogs running at large which were not properly muzzled. In this way many valueless dogs were destroyed. The law required every dog to be taxed and to wear a tag upon one side of which shall be stamped in raised letters the following: "dog tax for — (naming the year) paid." it becomes the duty of the constable of the district to kill all dogs not wearing tags, and for which services said constable shall be entitled to receive, for each dog killed by him, the sum of fifty cents from the county commissioners. If this law was rigidly enforced it would go far to stamping out this disease. A number of people as well as a great number of large animals, such as horses, cattle, etc., have been bitten by rabid animals.

A synopsis of the various outbreaks will be found in the following table:

RABIES

County	Number of cases reported	Animals quarantined	Localities quarantined	Animals destroyed	Persons bitten
Adams,	3	18	1	57	3
Allegheny,	8	10			12
Beaver,	1				1
Berks,	8	30		8	2
Bradford,	4				5
Bucks,	5	24			1
Butler,	2	8			3
Cambria,	13	40		16	16
Cameron,	2	7			2
Chester,	31	378	1	86	18
Clarion,	1	15		5	
Centre,	1	6			
Clearfield,	6	30		7	8
Columbia,	1	4			
Crawford,		1			
Delaware,	32	302	3	85	14
Erie,	1				1
Fayette,	23	144	1	366	16
Greene,	3	291	1	137	6
Indiana,	4	58		2	
Jefferson,	2	24	1	6	
Juniata,	2	14			5
Lackawanna,	10	82		8	3
Lancaster,	3	32		4	2
Lawrence,	5	10			7
Lehigh,	1				1
Luzerne,	21	111		125	16
Lycoming,	2	15			1
Mercer,	3	2			2
McKean,	3	31			1
Monroe,	1	11			
Montgomery,	41	342	2	51	16
Montour,	3	17			
Northampton,	6	8		19	9
Northumberland,	1				
Philadelphia,	84	87		14	20
Snyder,	2	123			1
Susquehanna,	2	142		11	
Union,	7	24			3
Washington,	4	10			
Wayne,	1	64			
Westmoreland,	16	70	1	86	15
Wyoming,	4	46		2	1
York,	8	116	1	6	1

MANGE

There have been no extensive outbreaks of mange during 1910 except in Philadelphia, where there were fifty-four cases reported, and it was found necessary to destroy eleven of these animals. In thirteen other counties, supposed cases were reported, but it was not necessary to destroy any of the animals. They were quarantined on the premises and treated according to the regular method of the State Livestock Sanitary Board, which consists of a lime and a sulphur wash.

The following table will give an outline of the supposed cases, animals affected as well as animals cured and released:

MANGE

County	Number of supposed cases reported	Number stables inspected	Number of animals examined	Number of animals affected and quarantined	Number of animals cured and released from quarantine	Number of animals died and destroyed
Berks,	7	7	31	18	18	
Bradford,						
Bucks,	5	5	10	10	10	
Delaware,	1	1	2	2	2	
Franklin,	1	1	1	1	1	
Indiana,	6	6	29	25	21	
Lackawanna,	2	2	7	7	7	
Lancaster,	1	1	1	1	1	
Lebanon,	1	1	1	1	1	
Luzerne,						
Mercer,	4	4	5	5	5	
Monroe,	3	3	3	3	3	
Montgomery,	3	3	6	6	6	
Philadelphia,	54	55	297	120	127	11
Susquehanna,	1	1	17	1	1	
Tioga,		1	1	2	2	

ANTHRAX

The State has been comparatively free from anthrax during the year 1910 as compared with former years. In the year 1909 this disease appeared in 161 herds, while in 1910 it occurred in only 71 herds, these herds being distributed throughout fifteen counties. Anthrax is due to a specific organism, known as the bacillus anthracis which is very resistant to disinfectants when in the sporulation stage. Animals dead of this disease should not be opened, as the bacilli do not form spores except in the presence of oxygen. To make a laboratory diagnosis, it only requires a few drops of the blood, and this can best be obtained by severing the ear from the body, placing it in a sterile jar and shipping direct to the laboratory for a microscopic and cultural study.

During the year there were 71 herds examined, consisting of 993 animals; all of which were vaccinated as quickly as possible after the report was received. However, in the 71 herds afore mentioned there were 100 animals died previous to the vaccination. The records show that no animals died following the vaccination, which goes to prove the value of the preventive vaccinations against anthrax.

The following table will show the distribution of the disease by counties; the number of herds affected; the number of animals vaccinated, as well as the number of animals that had died from each herd previous to vaccination:

ANTHRAX

County	Herds	Number of vaccinated animals	Number of Animals Dead	
			Previous to vaccination	Following vaccination
Berks,	8	68	21	
Bradford,	4	87	2	
Bucks,	2	43		
Chester,	11	203	2	
Elk,	1	3		
Erie,	4	141	17	
Jefferson,	2	8	5	
Lancaster,	1	9	1	
McKean,	15	205	18	
Montgomery,	2	12		
Potter,	5	26	10	
Sullivan,	1		6	
Susquehanna,	7	80	60	
Tioga,	7	84	12	
Warren,	1	24		

BLACKLEG

This disease is known as blackleg or blackquarter and has appeared in a number of counties throughout the State, representing 136 herds. All reports of outbreaks coming to the office of the State Livestock Sanitary Board were given early attention and animals not afflicted with the disease in said herds were vaccinated. Before the vaccination could be applied, 83 animals died, though only four animals died following the vaccination, which can be explained by the fact that the disease may have progressed to such an extent prior to the introduction of the vaccine that it was not capable of giving sufficient immunity to withstand or check the disease. The retarding of this disease is due largely to early vaccination, and after the places where the disease is most likely to occur or has occurred have been located. A careful oversight of these localities is maintained and vaccination is applied in advance of the pasturing season.

The following table will give a synopsis of the distribution of the disease and the work done in retarding the same:

BLACKLEG

County	Herds	Number of vaccinated animals	Number of Animals Dead	
			Previous to vaccination	Following vaccination
Bedford,	5	18	4	
Bradford,	11	89		1
Chester,	1	12	2	
Clarion,	2	9		
Elk,	2	9	16	
Erie,	24	281	6	
McKean,	1	8	4	
Potter,	3	50	2	
Somerset,	8	65	7	1
Snyder,	1	5	6	1
Sullivan,	2	13	3	
Susquehanna,	37	375	13	1
Tioga,	2	18	2	
Wayne,	27	258	9	
Warren,	3	80	5	
Westmoreland,	3	17	3	
Wyoming,	4	48	1	

ACTINOMYCOSIS

The State has been comparatively free from this disease during the period for which this report is made. During the year 1909 it appeared in 16 counties, representing a total number of 27 cases, while in the year 1910 it appeared in only 6 counties representing a total of 8 cases, all of which were either cured or destroyed as shown by the following table:

ACTINOMYCOSIS OR "LUMP JAW"

County	Number of Cases Reported	Action Taken
Bedford,	3	(1) Quarantined—treated by local veterinarian—cured—released. (2) No discharging lesion—no action. (3) Animal responded to treatment and was cured.
Clearfield,	1	Cow destroyed—carcass burned.
Indiana,	1	Animal treated—later destroyed on account of tuberculosis.
Jefferson,	1	Quarantined—treated by local veterinarian—cured—released.
Monroe,	1	Animal treated for a time, then slaughtered.
Venango,	1	Cow destroyed—carcass buried.

INSPECTION OF DAIRIES

The State Livestock Sanitary Board is authorized in section 6 of an Act approved March 30th, 1905, to co-operate with any local board of health in accordance with rules and regulations, and upon such terms of co-operation as may mutually be agreed upon for the purpose of ascertaining the condition of dairy herds and of milk supplies, and for the purpose of protecting such milk supplies from contamination.

During the past year there have been nine cities apply for co-operation in milk inspection work. These cities were Bloomsburg, Hanover, Ellwood City, Oil City, Siberly, Tidoute, West Pittston, Ingram and Wilkes-Barre. This inspection included the examination of 191 farms with the cattle contained thereon.

EPIZOOTIC LYMPHAGITIS

There has been very few cases of this disease reported during the past year. It appeared in eleven counties, but in only four of these counties was there more than one case. The total number of animals afflicted with the disease was 22, and 14 of these were destroyed. In 1909, 56 cases were reported and 23 of these it was necessary to destroy. It will be remembered that in 1908 the disease was quite prevalent throughout the western part of the State, and it is gratifying to note the gradual decrease and eradication of the same. This has been brought about by strict quarantine of all animals afflicted, as well as destroying those animals that were considered to be beyond the stage of recovery by therapeutic methods.

The following table will give the distribution of this disease by counties and the number of cases appearing in each county:

EPIZOOTIC LYMPHAGITIS

County	Cases Reported	Number Animals Destroyed
Allegheny,	1	
Armstrong,	3	3
Beaver,	7	3
Bradford,	1	1
Butler,	4	3
Clarion,		2
Delaware,	1	
Jefferson,	1	
Mercer,	1	1
Montgomery,	1	
Philadelphia,	2	1
Total,	22	14

TEXAS FEVER

There has been four outbreaks of Texas fever within the State. There were 409 cattle exposed, of which 12 were found to be affected; 9 of these animals died. These outbreaks were caused by the shipment of Southern cattle north and unloading them either for water or

at the slaughtering pens without observing the rules and regulations of the Board in regard to this disease.

In regard to cattle imported into the State for dairy purposes under the Act approved May 26, 1897 and amended by the Act of April 5, 1905, which makes it illegal to import animals for this purpose without having them tuberculin tested by a veterinarian approved by the State Livestock Sanitary Board, beg to say that there were 12,735 animals imported on permit and tuberculin tested at destination of which 56 reacted and were killed. There were 3,632 cattle discovered to be shipped without permit and afterwards tuberculin tested at destination. Out of this number, 53 reacted and were killed. The number of cattle tuberculin tested previous to shipment into Pennsylvania amounted to 1,288, of which 56 reacted and were not shipped. The latter number of animals were tested by qualified veterinarians approved by the authorities having control of the livestock sanitation in the respective states from which these cattle were shipped.

MISCELLANEOUS DISEASES

Of the various diseases reported to the Board, many of which are not contagious, I beg to submit the following report:

One case of gastro intestinal catarrh in sheep occurred in York county. Six sheep in the flock died and the last report indicated that the remaining 24 animals were apparently healthy.

One case of nasal catarrh was reported in a horse in Indiana county. Inasmuch as this condition is neither contagious or infectious it was not investigated.

One outbreak of abortion in Fayette county. The regular treatment was recommended and conditions improved.

Two outbreaks of cowpox were reported from Lehigh and Adams counties. The case in Adams county was treated by the local veterinarian under the direction of the Board at the owner's expense, and the case in Lehigh county was treated under our direction after having been investigated by one of our agents.

A case of profuse diarrhoea in a calf was reported from Lehigh county, but as the laboratory specimens did not reveal the same to be of a contagious or infectious nature, the owner was advised to obtain the services of the local veterinarian.

Two shipments of sheep affected with footrot were reported from the Pittsburg stockyards and were allowed to proceed to their destination for immediate slaughter under the conditions that the cars, pens, stalls, etc., occupied by the affected animals would be immediately and thoroughly cleaned and disinfected.

There was a report of an outbreak of distemper among horses in Franklin county, and it was investigated to prove conclusively that none of these horses were suffering from glanders. After this was done the animals were treated by the local veterinarian.

Three instances of supposed outbreaks of foot-and -mouth disease were reported from Philadelphia county, Cumberland and Lancaster counties, though after a careful investigation it was proven that this disease did not exist.

Among other outbreaks of supposed infectious, or contagious diseases reported to the Board and investigated by one of their agents consisted of one case of dog distemper in Blair county, two outbreaks of forage poisoning among horses in the United States army, camped at Gettysburg; four hundred horses and two hundred mules were in the camp. Seventeen horses were affected and three died. Two cases of garget; one in Cambria county and the other in Chester county. Three outbreaks of hemorrhagic septicaemia; one in Schuylkill county and two in Potter county. Five cases of supposed mange which, upon examination, was found that the irritation of the skin was caused by lice. One case of paralysis of a cow in Northampton county. One outbreak of a disease among sheep in Franklin county, and upon laboratory examination was found to be caused by the parasite known as oestrus orvis. Eighty-three cases of supposed infectious or contagious diseases were reported to the Board, but after corresponding with the owners and veterinarians in charge, it was decided that they were not infectious or contagious and therefore did not come within the scope of the work of the State Livestock Sanitary Board. Seventy-eight cases were reported to this office in which no definite diagnosis could be made owing to the fact that the history was not complete or that the specimen submitted was not in condition for examinaion. In other instances, when an agent of the Board arrived at the premises, no animal was available for postmortem examination and none of the other animals were showing any symptoms sufficient to warrant a diagnosis.

REGISTRATION OF STALLIONS

The work of the registration and licensing of stallions as provided for in the Act approved April 25, 1907, has been under the direct supervision of Dr. Carl W. Gay, assisted by Dr. James McCloskey. Dr. Gay has had this work in charge since its inauguration, and I beg to submit the following report from him for the year 1910.

Statistics for this, the third year during which the stallion law has been in effect, show the number of stallions in the State to be increasing rather rapidly, a total of 2,385 having been licensed, of which 908 are pure breds, 1,474 grades, and 3 cross breds. Those of pure breeding have, as was the case during 1909, made decided advancement, 85 in number or more than 10 per cent,, while the grades have gained 47 or 3.3 per cent. The different breeds of pure breds are represented as follows:

Percheron	315	Thoroughbred	10
Standardbred	289	Morgan	9
Belgian	66	Saddle	7
German Coach	46	Cleveland Bay	3
Shire	43	Shetland	3
Cyldesdale	33	Suffolk	1
French Draft	29	Yorkshire	1
Hackney	26	Orloff	1
French Coach	25	Welsh Pony	1

All the breeds have not progressed proportionately, in fact some have decreased in numbers this year; others have remained stationary. Those which have changed, and the number of increase and decrease as well as those which have remained unchanged are:

Increased		Stationary	Decreased	
Standardbred ...	36	Shire	French Draft	4
Precheron	25	Thoroughbred	Hackney	3
Belgian	18	Suffolk	Morgan	2
German Coach ..	10	Orloff	Cleveland Bay	2
Clydesdale	3	Yorkshire		
French Coach ...	1			
Saddle	1			
Shetland	1			
Welsh	1			

The Belgians are again the leaders in proportionate increase with 37 per cent.

Bulletin No. 187, "Directory of Stallions," containing the names and addresses of al the stallion owners in the State, also the names and particular breeds of all pure breds, was published and forwarded to all stallion owners, prothonotaries, veterinarians, and many others. The list is arranged by counties so that any interested person can easily locate the stallions in any particular vicinity, as well as become informed concerning the breed to which each belongs. Circular No. 18, "Report of Stallion Licenses Issued Prior to June 1, 1910," was also issued and given wide distribution for the purpose of locating any stallion which might be standing without a license. Very few owners were reported as not having licensed their stallions.

There seems to be much misunderstanding concerning the recording of each stallion with the prothonotary of the county wherein the stallion is stood. It has been ruled that the stallion owner must record the original license certificate only which recording is sufficient and need not be repeated for the annual renewal of the license.

Every state in the Union, with the exception of eight, one of which is Pennsylvania, has a lien law, which gives to the stallion owner, provided he complies with the requirements of the law, a lien on the get, or dam and get, for the service fee agreed upon. Such a law would greatly benefit the horse breeding industry of this State, inasmuch as stallions of exceptional merit would be brought into the State, their owners knowing they could collect their fees with but slight litigation. As conditions now exist, stallion owners experience considerable difficulty in making such collections and many are never paid. Numerous communications have been received recommending legislation in this direction.

The United States Department of Agriculture estimates the number of horses in Pennsylvania on January 1, 1910 at 619,000, with

an average valuation of $132.00, and total value of $81,708,000; also 43,000 mules at $145.00 each, worth $6,235,000. Of this great number of horses and mules, a large percentage are bred outside of the State and brought here, either as weanlings, yearlings, or at a more mature age. It is a practice of some of our best agricultural counties for farmers to buy weanlings and yearlings which are brought in in car lots by dealers who furnish no pedigrees and probably do not know either the sire or dam of the animals they are selling. Buying such colts is a very poor policy because their breeders, who are familiar with the parentage evidently do not care to raise such horses, as they have a good idea what the finished product will be. The farmer who buys such a colt does not know whether the sire is a ton Percheron or a cross roads scrub, and whether the colt will develop into a drafter, or turn out a nondescript; but he must in the great majority of cases be satisfied with the latter type. Good mares used for farm work and bred every year to suitable stallions, would in a few years cause their owners to reap a considerable profit from the sale of young horses which could be raised at no great trouble or expense.

As in the two preceding years, exhibits were made at various county fairs. The collection of photographs which clearly illustrate the various market types of horses as well as numerous charts showing the relative proportion of grade and pure bred stallions, comparative representation of breeds, the number of pure breds standing in each county, and relative increase of pure breds over grades, were exhibited. This exhibit was always placed prominently in space which was gratuitously offered by the various associations. A supply of all literature published by the Board pertaining to the horse industry was made available for all who cared for it, and a representative of the Board was present to discuss horse breeding topics. In this way many owners were informed concerning the stallions in their localities and inclined in the direction of breeding.

At the annual meeting of the State Breeders Association in Philadelphia, a demonstration of market types of horses, using as subjects typical representatives of the various classes, kindly loaned for the occasion by the owners, was given. An exceptionally good exhibit of Percheron and French Coach stallions, the property of McLaughlin Bros., of Columbus, Ohio was in the building during the entire meeting and was greatly appreciated. Discussions of the horse industry as well as demonstrations at Farmer's institutes and county fairs for the purpose of giving the farmers a better idea of proper selection in the breeding of horses were carried on as a part of the educational work which has been found most essential throughout the State, especially in the eastern section.

Much confusion has been caused stallion owners and buyers by alleged irregular practices of authorized pedigree registry associations, and the activities of others which have no government recognition.

Total number of licenses issued during 1910 was 2,385, as compared with a total of 2,254 for 1909, a gain of 131 or 5.3 per cent. The number of pure bred licenses issued in 1910 was 908, against 825 for 1909, a gain of 85 or 10.3 per cent. There were 1,474 grade licenses issued as compared with 1,427 during 1909, an increase of 47 or less than 3.3 per cent. Three cross bred licenses were issued against 4 in 1909.

REPORT OF THE BACTERIOLOGICAL LABORATORY

The pathological and bacteriological work including the preparations of tuberculin, mallein, anthrax vaccine and the diagnosis of all specimens received has been done by Dr. John Reichel, Chief of the laboratory assisted by Dr. John H. Engle and Dr. Edward Records.

The following report is submitted by Dr. Reichel, showing the character and amount of work done by the laboratory during the past year:

The work of the Laboratory of the Pennsylvania State Livestock Sanitary Board for the year 1910 may be briefly summarized as follows:

TUBERCULIN. 28,720 c. c. of concentrated tuberculin have been made requiring the inoculation of 2,233 flasks, each containing 200 c. c., 19 flasks, each containing 1,000 c. c. and 22 flasks, each containing 500 c. c. of neutral glycerin bouillon. The name strains of tubercle bacilli were used as in 1909. Tuberculin made from the various type of tubercle bacilli including human, bovine, and avian, was kept separate and an attempt was made to send tuberculin prepared with tubercle bacilli of the human type in the testing of cattle for the first time. Where it was known that cattle were to be retested or re-test tuberculin was requested, tuberculin prepared with tubercle bacilli of the bovine type was sent. Tuberculin made with tubercle bacilli of the ovian type was used for experimental purposes only. During the year, 41,030 doses of tuberculin, containing 0.4 c. c. of concentrated tuberculin, were sent out for the initial test of cattle; 1,903 doses, containing 1.2 c. c. of concentrated tuberculin, for re-testing; 54, containing more or less concentrated tuberculin for special purposes.

TUBERCULOSIS VACCINES. Nearly 1,000 c. c. of vaccine were prepared but not all used, in that some of the experimental work was discontinued during the latter part of the year.

MALLEIN. 900 c. c. of concentrated mallein have been made. Of this, 1,425 doses, each containing 0.25 c. c. of concentrated mallein were used in the initial test; 429 doses, each containing 1.2 c. c. of concentrated mallein, for re-testing.

ANTHRAX VACCINE. 1,379 doses of anthrax vaccine No. 1 and No. 2 for cattle; 71 doses of No. 1 and No. 2 for horses, were sent out from the laboratory. In one instance it was advisable to follow anthrax vaccine No. 2 with anthrax vaccine No. 3, and 11 doses for cattle and 6 doses for horses were sent out for that purpose. Reports following vaccinations were uniformly good.

AUTO-VACCINES. During the year, 61 specimens of pus were received for the purpose of making a vaccine from the growth of the bacteria in the pus. These specimens included material from cases of pyogenic infections such as fistula of the withers, pole evil, quittor, abscesses and infected wounds in horses and mules. The method of procedure followed in the collecting of a specimen and the preparation of vaccine is as follows:

The material is collected upon sterile cotton swabs in test tubes supplied for that purpose. Upon their arrival at the Laboratory, a small portion of the material is placed in a flask containing ap-

proximately 25 c. c. of plain bouillon. After an incubation of 24 hours with the development of a heavy growth, the culture is heated to 60° for one hour, whereupon sub-cultures are made and the heated culture is placed in three test tubes. The test tubes containing the heated culture or vaccine are held for 24 hours and if at the end of that time the sub-cultures made from the heated culture have remained sterile, the three test tubes of vaccine are sent to the sender of the specimen with directions that an injection may be made with the vaccine from one of the test tubes, using as a dose, from 2 to 3 c. c. The injection of vaccine may be repeated in from 5 to 8 days.

The reports received of the results obtained from the use of the vaccine prepared during the year, have been exceedingly encouraging in many instances and in others apparently no improvement was noted following the injections.

SPECIMENS RECEIVED FOR EXAMINATION. During the year, 1,012 specimens were received at the Laboratory, including:

Rabies. 527 heads of animals were examined. Of these, 62 heads of rabbits are included of which 30 were positive and 32 negative. The rabbits served as experimental animals in those cases in which the miscroscopic examination failed to show conclusive evidence. Of the remaining 465 heads, 408 were dogs, 335 positive, 49 negative, and 24 were not examined; 33 of cattle, 24 positive, 8 negative and 1 not examined; 6 cats, 2 positive, 3 negative and 1 not examined; 5 horses, 5 positive; 6 hogs, 4 positive, 1 negative and 1 not examined; the brains of 3 human beings, all three positive (hydrophobia); 1 mule not examined; 1 sheep, positive; 1 deer, negative; one goat, negative.

Tuberculosis. 63 specimens were received for examination, including, 45 from cattle, 5 from hogs, 4 from human beings, 4 chickens, 2 cats, 1 dog, 1 horse and 1 parrot. The presence of tubercle bacilli was demonstrated in 48, and in 15 the examination failed to reveal the presence of the organism. The number of specimens examined for tubercle bacilli is proportionately larger upon including the examination of the feces of 40 cattle, which was started in April and completed in September. The general plan followed in the examination is as follows:

Cattle. Forty in all were selected from those of the Experimental Farm of the Pennsylvania State Livestock Sanitary Board. All of the cattle upon the Experimental Farm serve wholly or in part in experiments with tuberculosis. In the selection, cattle with tuberculosis and some free of tuberculosis were included under three classes:

1. Tuberculin reacting cattle with physical symptoms of tuberculosis.
2. Tuberculin reacting cattle showing no physical symptoms of tuberculosis.
3. Immunized cattle free of tuberculosis.

Material for Examination. Each morning for eleven days, approximately 75 grams of feces were collected in a sterile bottle with a sterile glass slide from manure freshly dropped by each animal included in the examination. In the afternoon of each day the feces was collected, a smear preparation on a glass slide, of the feces in each bottle was made for miscroscopic examination. The 75

grams of feces were then mixed with approximately 250 grams of finely chopped carrots and fed to four guinea pigs set aside in separate cages for each bovine included in the examination. During one of the 1 days on which feces was collected and fed, a rectal scraping was taken from each of the forty cattle. A currette was inserted approximately 8 inches into the rectum, and on the withdrawal of the instrument, feces clinging to the side of the bowel and some of the superficial layers of the mucous membrane of the rectum were included in the currettement. The material was placed in separate sterile bottles. With an emulsion of the rectal scrapings, two of the four guinea pigs fed feces from the same animal from which the rectal scrapings was taken, were injected subcutaneously over the abdomen. Where the guinea pigs died shortly following the injection two, and in some instances four more guinea pigs were added to the cage and injected before the feeding of the feces ended. In this way, at least two guinea pigs lived long enough for lesions to develop at the end of the 11 days during which feces were fed. All of the guinea pigs alive at the end of from 8 to 9 weeks were chloroformed and carefully autopsied. When lesions resembling tuberculosis were found, a rabbit was inoculated with an emulsion of one of the lesions of at least one guinea pig included in the examination of the feces of each bovine, to determine whether or not the tubercle bacilli would infect the rabbit, thereby giving an indication of their virulence.

The smear preparations of the feces collected were stained and a large number examined microscopically.

The following tables include a brief description of each animal, history, result of examination of feces (animal inoculation test) and summary of lesions found at autopsy of the cattle slaughtered:

NO. 1. TUBERCULIN REACTING CATTLE WITH PHYSICAL SYMPTOMS OF TUBERCULOSIS

Animal	Reacted to Tuberculin	Remarks	Exem. of Feces (Animal Inoc. Test)	Autopsy
(a)				
No. 1567 Grade Cow,---	1908,	Tuberculosis of vulva, cough and emaciation.	T. B. demonstrated,*------	Prescapular Lymph glands XXX. Med. L. Gl. X. R. Bronchial Gl. X. Sublumbar L. gl. XXXX. Liver X. Vulva XX ("open" lesions.)
No. 1564 Grade Cow,---	1908,	Tuberculosis of vulva, cough and emaciation.	T. B. demonstrated,**------	Prescapular L. Gl. XXX. Cervical L. Gl. XXX. Udder X, Pleura XXX, Peritonsum XX, Sublumbar L. gl XX, Liver X, Genital organs XX ("open" lesions.)
No. 1565 Grade Cow,---	1908,	Tuberculosis of vulva, cough and emaciation.	T. B. demonstrated,***----	Supra-mammary gl. XX, left bron. gl. X, sublumbar L. gl. X, vulva XXX. ("open" lesions.)
No. 752 Grade Heifer,--	Jan. 1909,	Enlarged postpharyngeal gland, cough and emaciation.	T. B. demonstrated,†------	Postpharyngoal gl. XX sub-maxillary salivary gl. X, Mediastinal L. Gl. X, Lungs XX, Bronachial L. gl. X, Mesentaric L. gl. XXX, Intestines X, Liver X. ("open" lesions.)
No. 733 Jersey Cow, (Registered.)	Dec. 1906,	Frequent deep-seated cough.	T. B. demonstrated,‡-------	Postpharyngeal gl. X, Larynx XXX, Pleura X, Mediastinal L. Gl. XX, Bronchial L. Gl. XX, Lungs XX, Mesenteric L. Gl. XXXX, Liver X, ("open" lesions.)
(b)				
No. 749 Grade Steer,--	Jan. 1909,	Enlarged postpharyngeal glands.	T. B. not demonstrated,--	Postpharyngeal Gl. XXX, Mediastinal Gl. X. Lungs X.
No. 753 Grade Heifer,--	Nov. 1907,	Enlarged postpharyngeal glands.	T. B. not demonstrated,--	L. Postpharyngeal Gl. XXX, Mediastinal Gl. XX, Bronchial Gl. XXX, Lungs XX, Mesenteric L. Gl. XX.
No. 732 Jersey Cow,--	Dec. 1906,	Frequent deep-seated cough and emaciation.	T. B. not demonstrated,--	Larynx XX, Pleura XX, Mediastinal Gl. XX, Bronchial Gl. XX, Lunga XX, Mesenteric Gl. XX, Liver XX.
No. 2046 Jersey Steer,	April 1909,	Enlarged Cervical L. glands and emaciation (infected by intravenous injections of virulent bovine bacilli.		Cervical L. gland XX, Pleura XX, Mediastinal gland XX, Bronchial Gland XX, Lungs XX.

NO. 1. TUBERCULIN REACTING CATTLE WITH PHYSICAL SYMPTOMS OF TUBERCULOSIS.—Continued.

Animal	Reacted on Tuberculin	Remarks	Exem. of Fees (Animal Inoc. Test)	Autopsy
(c)				
No. 1503 Jersey Cow,-- (Imported.)	Oct. 1907,	Frequent deep-seated cough and emaciation.	T. B. not demonstrated,--	Not yet slaughtered.
No. 1566 Grade Cow,-- (Registered.)	1908,	Visible tuberculosis of vulva.	T. B. not demonstrated,--	Not yet slaughtered.
No. 193[illegible] Jersey Cow, (Registered.)	1908.	Unthrifty and emaciated.	T. B. not demonstrated,--	Not yet slaughtered.

*Rabbit, weight 1,730, inoculated 6/11/10, with emulsion of lesion of G. P. Dead 9/2/10, weight 1,410 grams—Generalized Tuberculosis.
**Rabit, weight 1,770 grams, inoculated 5/31/10 with emulsion of lesions of G. P. Dead 7/29/10, weight 1,330 grams—Generalized Tuberculosis.
***Rabbit, weight 1,550 grams, inoculated 6/13/10 with emulsion of lesions of G. P. Dead 8/26/10, weight 1,300 grams—Generalized Tuberculosis.
†Rabbit, weight 1,450 grams, inoculated 6/1/10 with emulsion of lesions of G. P. Dead 8/11/10, weight 1,210 grams—Generalized Tuberculosis.
‡Rabbit, weight 2,150 grams, inoculated 5/31/10 with emulsion of lesions of G. P. Dead 8/13/10—Generalized Tuberculosis.

NO. 11. TUBERCULIN REACTING CATTLE SHOWING NO PHYSICAL SYMPTOMS OF TUBERCULOSIS

Animal	Reacted on Tuberculin	Remarks	Exem. of Feces (Animal Inoc. Test)	Autopsy
(a)				
No. 716 Aryshire Cow, (Registered.)	Jan. 1907,	Associated with other tuberculous cows.	T. B. demonstrated,*-------	Not yet slaughtered. (Reserved to take part in other exp. work.)
No. 713 Aryshire Cow,	Jan. 1907,	Associated with other tuberculous cows.	T. B. demonstrated,**------	Not yet slaughtered. (Reserved to take part in other exp. work.)
No. 796 Aryshire Cow,	Dec. 1907,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Lungs X, Post. Med. Gl. X, "Closed" lesions.)
No. 759 Grade Steer,	July 1907,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Mediastinal L. Gl. XX, bronchial Gl. XX, Lungs XX, ("Closed" lesions).
No. 745 Grade Steer,	Nov. 1907,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Mediastinal Gl. X, left bronchial Gl. X, lungs X, ("Closed" lesions).
No. 740 Grade Heifer,	Jan. 1909,	Associated with other tuberculous cows.	T. B. not demonstrated,--	Mesenteric L. Gl. XXX.
(b)				
(c)				
No. 1502 Jersey Cow, (Imported.)	Oct. 1907,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.
No. 791 Jersey Cow, (Registered.)	Dec. 1907,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.
No. 794 Jersey Cow,-- (Registered.)	Dec. 1907,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.
No. 722 Aryshire Cow,--	Jan. 1907,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.
No. 1500 Aryshire Cow, (Imported.)	Oct. 1907,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.
No. 725 Jersey Cow.-- (Ordinary.)	Dec. 1906,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.

NO. 11. TUBERCULIN REACTING CATTLE SHOWING NO PHYSICAL SYMPTOMS OF TUBERCULOSIS.—Continued.

Animal	Reacted on Tuberculin	Remarks	Exem. of Fees (Animal Inoc. Test)	Autopsy
No. 730 Jersey Cow,---	Dec. 1906,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.
No. 1506 Jersey Cow,--	Oct. 1907,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.
No. 708 Aryshire Cow,--	Jan. 1907,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.
No. 714 Aryshire Cow,--	Jan. 1907,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.
No. 1570 Aryshire Cow,	Oct. 1908,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.
No. 20 Guernsey Cow,--	Oct. 1908,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.
No. 659 Jersey Cow,--	Nov. 1909,	Associated with other tuberculous cows.	T. B. not demonstrated,---	Not yet slaughtered.

*Rabbit, weight 1,240 grams, inoculated 6/13 with lesions of guinea pig, died 8/10/10. Weight 950 grams—Generalized Tuberculosis.

**Two rabbits inoculated 7/1/10 with emulsions of the lesions in the lungs of two G. P. Were killed 9/12/10 showing no lesions of T. B. at autopsy. T. B., however, were demonstrated in the lesions of the lungs of the G. P. with which the rabbits were inoculated, and in that the rabbits failed to become infected, the conclusion that the T. B. were of exceedingly low virulence is permissable.

NO. 111. IMMUNIZED CATTLE FREE OF TUBERCULOSIS

Animal	Remarks	Exam. of Feces (Animal Inoc. Test)	Autopsy
(a) No. 661 Grade Heifer,--	Associated for 3 years with highly tuberculous cattle in infected stable.	Presence of T. B. demonstrated.	No lesions of T. B. G. P. inoculated with scrapings of reddened mucous membrane of large intestine remained healthy.
No. 742 Grade Steer,--	Associated for 3 years with highly tuberculous cattle in infected stable.	Presence of T. B. demonstrated.	No lesions of T. B. G. P. inoculated with scrapings of reddened mucous membrane of large intestine remained healthy.
No. 776 Grade Steer,--	Associated for 3 years with highly tuberculous cattle in infected stable.	T. B. not demonstrated.	No lesions of T. B. found.
No. 784 Grade Steer,--	Associated for 3 years with highly tuberculous cattle in infected stable.	T. B. not demonstrated.	No lesions of T. B. found.
No. 782 Grade Steer,--	Associated for 3 years with highly tuberculous cattle in infected stable.	T. B. not demonstrated.	No lesions of T. B. found.
No. 738 Grade Steer, --	Associated for 3 years with highly tuberculous cattle in infected stable.	T. B. not demonstrated.	No lesions of T. B. found.
No. 747 Grade Heifer,--	Associated for 3 years with highly tuberculous cattle in infected stable.	T. B. not demonstrated.	No lesions of T. B. found.
No. 739 Grade Heifer,--	Associated for 3 years with highly tuberculous cattle in infected stable.	T. B. not demonstrated.	No lesions of T. B. found.
No. 786 Jersey Heifer,--	Not associated with tuberculous cows or in infected stable.	T. B. not demonstrated.	No lesions of T. B. found.

Conclusions. 1. The microscopic examination of the feces or rectal scrapings of cattle for tubercle bacilli is of no value, in that many bacteria make their appearance in the feces of rectal scrapings, with the morphology and staining characteristics of tubercle bacilli which, however, fail to prove themselves as such.

2. "The animal inoculation test," i. e., the injection of guinea pigs with feces and rectal scrapings of cattle is a valuable, although not an infallible test. It can be relied upon when the guinea pigs injected develop tuberculosis as a result of the injection. Feeding material suspected of containing tubercle bacilli to guinea pigs has shown itself of little value, in that only 3 (20 per cent.) of the guinea pigs fed feces with tubercle bacilli developed tuberculosis.

3. Of the forty cattle included in the examination, 9 (22.5 per cent.) were found to be throwing off virulent tubercle bacilli in the feces or rectal scrapings. Of these 9 cattle, the tubercle bacilli were found virulent for guinea pigs, and in 8 of 9, the tubercle bacilli were virulent for rabbits.

4. The successful demonstration of tubercle bacilli in the feces or rectal scrapings of cattle is either proof that extensive or "open" lesions of tuberculosis exist, or an indication that tubercle bacilli ingested are passing through the length of the alimentary canal of the animal under examination.

5. Cattle with "open" lesions of tuberculosis, and throwing off tubercle bacilli in the feces or rectal scrapings, as a rule, show physical symptoms of the disease.

6. The demonstration of tubercle bacilli in the feces or rectal scrapings of cattle apparently free of tuberculosis, but stabled with highly infected cattle, may be accepted as an indication that tubercle bacilli are passing through such cattle,—the tubercle bacilli being ingested and thrown off in numbers large enough to be demonstratable in the feces or rectal scrapings.

7. Cattle showing physical symptoms of tuberculosis are the most active disseminators of the disease, because of the probable existence of "open" lesions, and the likelihood that tubercle bacilli are thrown off in the excreta. Since they show physical symptoms, they may be detected in a herd by a consideration of the history, careful observation and a thorough examination of each animal.

8. Tuberculin reacting cattle do not necessarily throw off tubercle bacilli in the feces until the development of "open" lesions of tuberculosis, in which event, the condition may be detected by a consideration of the history, careful observation and a complete physical examination.

Glanders. Material collected from suspected cases of glanders were received in the form of 78 specimens of which all but 5 were examined. Of the 73 examined, the presence of bacillus, mallei was demonstrated in 18, and in 55 the demonstration was not successful. Only a few specimens of blood were included in the specimens received, but the glanders agglutination test was not carried out in a single instance during the entire year.

Epizootic Lymphangitis. Fifteen specimens of pus were received for examination and 5 of these did not include enough material to make a satisfactory examination possible. The sacchromyces farciminous or sporothrix farciminosus was demonstrated in 10. Two in which a diagnosis of epizootic lymphangitis was made, were from horses in Philadelphia. In both of these instances the history of these horses prove conclusively that they were not out of Philadelphia during the past 5 years.

Anthrax. Twenty-five specimens were received for examination, including 24 from cattle and 1 from a horse. These specimens were not received from any one portion of the State, but came largely from the northeastern part. Anthrax bact. were demonstrated in 10; in 14 the organism was not found and in 1 no examination was made. Not infrequently during the year it was found advisable to infect and cause the death of guinea pigs in order to prove unquestionably that the organism isolated from the specimen received was anthrax bact. of the virulent type.

Hog Cholera. Twenty-two specimens were received, not so much for diagnostic purposes, but to have the diagnosis made upon the field confirmed. In 16 the diagnosis was confirmed; 3 were considered negative; 1 doubtful, and 2 were not examined. In several instances

where tissue changes were not characteristic of hog cholera, hogs were inoculated with available material upon the Experimental Farm and the diagnosis was confirmed in several instances in this way.

Actinomycocis. Five specimens were received. A positive diagnosis was made following the examination of 3; 1 remained negative and 1 was considered doubtful. The examination was limited to the microscopic examination of smears of the material received.

Chronic Bacterial Dysentery. A large number of specimens were brought to the laboratory for examination, consisting chiefly of feces and rectal scrapings of individual cattle. These were brought to the laboratory in 20 separate lots including at times feces and rectal scrapings of 60 cattle in one lot. The acid-fast bacilli were demonstrated in the feces and rectal scrapings of 5 cattle, whereupon the diagnosis of chronic bacterial dysentery was made.

Symptomatic Anthrax Blackleg. Seven specimens were received. In 4 the presence of the bacillus of symptomatic anthrax was demonstrated in the muscle tissue of guinea pigs inoculated with the suspected material. An examination failed to give positive results in 2 instances and in one instance the examination was unsatisfactory.

Hemorrhagic Septicemia. Sections of the internal organs of 8 cattle were received from the northeastern part of the State, suspected of having died of hemorrhagic septicemia. From the gross lesions and the demonstration in the smears of a bipolar oval staining organism resembling the bacillus bovo-septicus, a diagnosis of hemorrhagic septicemia was made in six instances and in one instance the material received could not be examined owing to decomposition.

Mange. Thirteen specimens of skin scrapings from horses with suspected mange were received. The sarcoptes scabiei was demonstrated in 3 and not demonstrated in 10.

Milk. Seventeen sets of samples were received during the year. Of these 11 were examined for the number of bacteria per cubic centimeter; 4 sets were brought to the laboratory to take part in an experiment, and 2 sets were too long in getting to the laboratory and arrived in poor condition.

Miscellaneous Specimens. These included specimens from 13 chickens, 1 duck, parasites from 6 cattle, 5 sheep, 2 dogs, 2 hogs, and 1 human being; a portion of lung tissue from a cow in which the pneumonic process was caused by an infiltration of the aspergillas fumigatis; tumors removed from 12 horses, 12 dogs, 4 mules, 2 cattle, 2 chickens, and 1 sheep; and many other specimens which could not readily be classified.

The following report of some work personally conducted by the writer upon the eradication of tuberculosis from a large herd is presented herewith:

THE RESULTS OBTAINED IN THE ERADICATION OF TUBERCULOSIS FROM A HERD BY THE USE OF TUBERCULOSIS VACCINE AND THE BANG SYSTEM

By S. H. GILLILAND, V. M. D., M. D., State Veterinarian and Secretary of the State Livestock Sanitary Board of Pennsylvania.

(From the Laboratory of the State Livestock Sanitary Board of Pennsylvania.)

In 1902 Dr. Leonard Pearson and the writer published "Some expermiments upon the immunization of cattle against Tuberculosis" and their conclusions were as follows:—

"1. That after repeated intravenous injections of cultures of tubercle bacilli from human sputum the resistance of young cattle to virulent tubercle bacilli of bovine origin may be increased to such an extent that they are not injured by inoculation with quantities of such cultures that are capable of causing death or extensive infection of cattle not similarly protected.

"2. That by intravenous injection much larger quantities of human sputum tubercle bacilli than are necessary to confer a high degree of resistance or immunity upon the vaccinated animal may be administered without danger to that animal."

Since that time many others have reported upon experiments with the object of increasing the resistance of cattle toward the tubercle bacilli. Among these have been Von Behring, Hutyra, Klimer, Schultz, Arloing, Courmont, Moussu, Neufeld and Meissner, Vallee, Weber and Fitze, Eber, Hohler and Schroeder, Trudeau and Baldwin, and many others in this county and abroad have done much work upon the subject.

Owing to the great volume of literature on this problem, I shall not attempt to incorporate an abstract of the same in this paper.

In 1904 Dr. Leonard Pearson was called upon to give advice relative to the eradication of tuberculosis from a herd consisting of approximately 200 head of cattle, including dry cows, bulls and heifers over one year of age. At the conference it was decided that the herd should be carefully tested with tuberculin, all reactors to be removed from the main barn and kept rigidly isolated from non-reactors. The herd consisted of thoroughbred Guernseys, Holsteins and grades, and it was further agreed upon that if any of the most valuable animals should react they were to be isolated, placed upon the Bang system, and to be treated with tuberculosis vaccine with the object of saving their offspring. This work was placed in my charge, and has been under my direct supervision since the start.

A thorough tuberculin test was made during May 1904 of the milking herd consisting of 160 animals, of which 42 animals, or 26.2

per cent, reacted. Calves under eight months of age were excluded from the test, owing to the fact that the preliminary temperatures were too high to make the test of any value.

The reacting animals were removed immediately from the herd. A number of these animals were registered, some of which had taken prizes at the Buffalo Exposition in the Guernsey Class. Nearly all of these reactors were in various periods of gestation and it was considered advisable to keep them for their offspring. They were placed in a stable approximately 100 yards from the stables in which the main herd is kept, and situated at the foot of a hill, thereby permitting no drainage from this infected stable to the other buildings. It was the duty of one man to care for these reactors, and he was *not* permitted to mingle with the employees of the milking herd, visit the stables, or to allow any interchange of utensils such as buckets, forks, shovels, wheelbarrows, etc., from the infected stable to any of the other stables. I shall refer to these reactors later in the article, but will now ask your attention to the care of the milking herd.

The main milking herd was stabled in four barns, varying from 12 to 48 animals in each barn. Inasmuch as some reactors had been found in every barn, a thorough disinfection of all stables was made. The windows and doors of the barns were tightly sealed and the interior filled with formaldehyde gas, the gas being generated by the addition of potassium permanganate to formalin, and left sealed for 18 to 20 hours; after which the doors and windows were opened and the stable thoroughly aired. The wood work and iron stanchions were washed with a solution of carbolic acid. The floors in all the stables except one were of cement, and were flushed with a solution of sulphate of iron and afterwards carbolic acid. A coat of whitewash including 2 per cent. carbolic acid was applied to the ceiling and walls. The manure was removed to the fields and the pit in which it was stored was covered with chloride of lime. The policy of this farm is not to pasture their milch cows, but to place them in a shady exercising yard a portion of the day. This yard was scraped, removing several inches of earth, and then covered with lime. All utensils around stables were disinfected.

Even with the disinfection as outlined, it was believed that there still might remain some possible points of infection in the stables or exercising yards. Also it seemed reasonable to believe that some non-reactors might carry within their body some tubercle bacilli which had not as yet had time to produce a distinct tubercle and therefore were incapable of giving a tuberculin reaction.

The method outlined at that time to eliminate all the suspicious animals and keep the herd free from tuberculosis was as follows:

First. All the animals in the milking herd were to be tuberculin tested every six months until two successive negative tests were obtained and then yearly thereafter.

Second. The calves that were intended to become future members of the milking herd were to be immunized by the use of intravenous injections of human tubercle bacilli which had been found by experimentation to be non-virulent for cattle.

Third. All cows newly purchased before being allowed to enter the main herd were to be placed in a quarantine stable about one hun-

dred and fifty feet from the regular barns in which the milking herd was kept and then tested with tuberculin.*

*I do not consider this plan the best method for handling newly purchased animals as there is a chance of reinfecting the herd. It appears to me that it would be far better if a regular quarantine barn could be maintained at least one hundred yards from the main buildings and all recently purchased animals be kept therein for a period of three months before entering the herd. This plan would permit of a tuberculin test at the time of purchase as well as another test just prior to entering the herd. In this manner it would be possible for one to detect any animals that were "plugged" by a dishonest dealer.

In the Spring of 1905, approximately one year from the first test, the herd was again tuberculin tested. Conditions arose which made a tuberculin test six months following the initial test, as originally planned, impossible. The results obtained were as follows:

Date of test, June, 1905.

Number of animals tested, ...	120
Number of animals reacted, ...	13
Percentage of animals reacting, ...	10.8

It was generally customary to apply the tuberculin test during the cool months of the Fall and Spring.

The tuberculin test in November of the year 1905, which was approximately five months from the preceding test, resulted as follows:

Number of animals tested, ...	137
Number of animals reacted, ...	7
Percentage of animals reacting, ...	5.1

The tuberculin tests following the date above mentioned up to the present time gave the following percentages of reaction:

Results of Tuberculin Tests, 1906.

Date of test, April.

Number of animals tested, ...	154
Number of animals reacted, ...	13
Percentages of reacting animals, ...	8.4

Date of test, November.

Number of animals tested, ...	137
Number of animals reacted, ...	5
Percentage of reacting animals, ...	3.6

You will note that the percentage of reactions obtained in April 1906, was 3.3 per cent. higher than those obtained in November 1905. The only explanation I can offer for this is the fact that during the winter months the animals were more closely stabled and were frequently changed from one stable to another. Again, there were a number of newly purchased animals entered into the herd during the Winter which had only been tested at the time of purchase, and

were not kept for any length of time separate from the main herd after their arrival at the farm.

I believe it is of value in the elimination of tuberculosis from a herd for each animal to have a certain stanchion or stall in which it remains during its time of service in the herd.

Results of Tuberculin Tests, 1907.

Date of test, April.

Number of animals tested, ...	201
Number of animals reacted, ...	0
Percentage of reacting animals, ...	0

Date of test, October.

Number of animals tested, ...	131
Number of animals reacted, ...	0
Percentage of reacting animals, ...	0

At the time of the October test there was one cow exhibited a rise of temperature to 104° F. at the sixteenth hour following injection, though all the temperature measurements prior to the sixteenth hour, as well as those following the sixteenth hour were below 102.5° F. Therefore she was not considered a positive reactor, though she was removed and isolated from the herd for six months when she was again tuberculin tested and gave a perfectly clean test and has continued to do so up to the present time.

Results of Tuberculin Tests, 1908.

Date of test, April.

Number of animals tested, ...	145
Number of animals reacted, ...	2
Percentage of reacting animals, ...	1.4

Date of test, November.

Number of animals tested, ...	169
Number of animals reacted, ...	3
Percentage of reacting animals, ...	1.8

The only explanation that I can offer for the reinfection of the herd is, that during this year the attendant of the tuberculous animals upon the Bang system, severed his connections with the farm and another man was obtained to do his work who was not as careful in seeing that there was no interchange of utensils used in the barn containing the tuberculous cows and the stables of the main milking herd. In investigating the matter I also was informed that he would constantly associate with the employees in charge of the milking herd.

Results of Tuberculin Test, 1909.

Date of test, April.

Number of animals tested, ...	151
Number of animals reacted, ...	0
Percentage of reacting animals, ...	0

On account of obtaining no reactions on this test and having a fear of injecting tuberculin too frequently, thereby destroying the sensitiveness of the body cells to the same no other test was made until the following year.

Result of Tuberculin Test, 1910.

Date of test, May.

Number of animals tested,	151
Number of animals reacted,	5
Percentage of reacting animals,	3.3

The explanation for the reinfection of the herd the second time is as follows: At the time of the test in November 1908, two cows gave a rather definite reaction. Inasmuch as they were valuable animals it was the owner's desire that they be held for a retest, which was granted. The history and tuberculin test of these two animals is rather interesting and I shall give the same in detail. The animals are known as Proceda and Francelmar. The test of 1908 in which they gave positive reactions is as follows:

TUBERCULIN TEST

Proceda.		*Francelmar.*
Preliminary temperatures.		Preliminary temperatures.
Nov. 20, 1908.		
5 A. M.	101.4	101.4
7 A. M.	102.	102.
9 A. M.	101.6	101.8
11 A. M.	101.6	101.6
1 P. M.	100.6	100.2
3 P. M.	101.	101.6
5 P. M.	101.6	102.4

Eight P. M. Injected—Dosage, 1 drachm of solution for each animal containing 1,200 milligrams concentrated tuberculin.

Temperatures following injection.		Temperatures following injection.
Nov. 21, 1908.		
5 A. M.	101.4	100.6
7 A. M.	102.2	101.4
9 A. M.	102.2	100.8
11 A. M.	102.4	101.6
1 P. M.	104.6	102.2
3 P. M.	106.6	104.
5 P. M.	105.	105.
7 P. M.	105.4	106.

I beg to call your attention to the fact that the rise of temperature did not occur until the seventeenth hour, though the reaction in both cases was very distinct. There have been many cases come to my attention while State Veterinarian of Pennsylvania and at other times, when the veterinarian applying the tuberculin test felt

that it was not necessary to take more than three temperature measurements following the injection of the tuberculin and that these measurements need not be taken after the sixteenth hour. It seems to me that we have ample proof to show that this is a very erroneous way of applying a test as valuable as the tuberculin test, and in this manner many animals have escaped.

These two animals were removed from the milking herd and placed in a barn some distance from the main stable and were attended by a party who had no connection with the milking herd, but who attended to a bull and a lot of calves which will be mentioned later. They were kept separate and their milk pasteurized for a period of eighty-two days, when they were again tuberculin tested with the following results:

TUBERCULIN TEST

Proceda.		*Francelmar.*
Preliminary temperatures.		Preliminary temperatures.
Feb. 10, '09.		
5 A. M.	102.4	102.4
7 A. M.	102.	102.1
9 A. M.	99.4	101.2
11 A. M.	99.4	100.4
1 P. M.	100.4	100.8
3 P. M.	100.6	101.
5 P. M.	102.2	101.4

Eight P. M. Injected—Dosage, 1 drachm of solution for each animal, containing 1,200 milligram concentrated tuberculin.

Temperatures following injection.		Temperatures following injection.
Feb. 11, '09.		
5 A. M.	102.6	100.6
7 A. M.	102.4	101.4
9 A. M.	100.6	101.
11 A. M.	101.2	102.
1 P. M.	103.	102.2
3 P. M.	101.2	101.4
5 P. M.	103.	101.6
7 P. M.	102.6	

It will be noted that the one animal gave a temperature at 1 P. M. of 103° and again at 5 P. M. of 103°, but the intermediate temperature at 3 P. M. was normal and it was considered that the irregularity in the temperature measurements was due to some other cause rather than tuberculosis. It has not been the experience of the writer that a tuberculous animal will give rise in temperature, a fall and then another rise following the injection of tuberculin unless there has been some local cause for the same, such as undue excitement, drinking cold water, feeding, milking, etc. Following this test, which was considered negative, these animals were returned to the milking herd. They were again tested on April 27, 1909 and May 4, 1910, at which time they both gave negative tests.

During the latter part of the summer of 1910, it was noticed by the superintendent of the farm that these two animals aforementioned, were not in the best of condition and were therefore again removed frm the herd and kept separate for several months, during which time they continued to lose flesh, coat became rough and cough increased. This action was taken by the superintendent during my absence abroad and upon my return I advised the killing of these two cows. The autopsy revealed extensive tuberculosis of the glands and other organs of both the thoracic and adominal cavities.

This experience taken in conjunction with a number of others that I have had during the past two years, leads me to believe that an animal that has once reacted to the tuberculin test in a positive manner must be considered a tubercular subject no matter what subsequent tests may reveal. It may be, however, that some reactors will live for a number of years following the date of their initial reaction without showing any clinical symptoms of tuberculosis. It is my belief that these two animals, namely Proceda and Francelmar, are responsible for the reinfection of the herd and of the percentage of reactions obtained during the year 1910.

As aforestated, five animals reacted during this year. One was an animal that had been purchased in New York State since the previous test. Another was an animal that had been purchased by an employee of the farm three or four months prior to the injection of tuberculin. This animal, however, was kept separate from the herd, but the owner was constantly associated with the milch cows as he had a certain number of animals to feed, milk and care for each day. The third animal was one that had been vaccinated with tuberculosis vaccine two years previous, and at the time of test showed an enlargement of the left fore knee joint. The reaction in this animal was not typical, but it was decided to sacrifice the same in order to determine the cause of the enlarged knee. Upon autopsy, it was found that the bursa through which the anterior extensor runs was greatly enlarged, indurated and inflamed. No microscopical lesions of tuberculosis could be found. Miscrocopical examination revealed no tubercle bacilli and guinea pigs inoculated with this material remained healthy for a period of three months, when they were killed, and all organs, membranes, etc., were found normal.

The remaining two reacting animals had been in the herd for more than two years, and upon autopsy, showed small processive foci of tuberculosis, in the various glands and organs.

The herd was not again tested for nine months, with the following results:

Result of Tuberculin Test, 1911.

Date of test, January.

Number of animals tested, ...	160
Number of animals reacted, ...	4
Percentage of reacting animals, ...	2.5

Four other animals which had received several years prior to the test four doses of tuberculosis vaccine, gave rather suspicious reactions and were removed from the herd, though two of them are not included in the above percentage of reactions, for upon autopsy they showed no lesions whatever.

It was not possible for the writer to be present at the autopsies, though Dr. B. T. Woodward of the Bureau of Animal Industry and Dr. W. L. Moss of John Hopkins conducted the same, and I have the following report from Dr. R. W. Hickman, Chief of the Quarantine Division of the Bureau of Animal Industry:

"Referring to cattle * * * * which were slaughtered at the Baltimore Butchers' Abattoir, Baltimore, Md., January 31st, and post-mortem examinations by Dr. B. T. Woodward of this office together with your representative, you are advised that the cow Turby immunized showed a supra-mammary gland the appearance of which was suspicious of tuberculosis. This tissue was submitted to the pathological division of the Bureau and two guinea pigs were inoculated February 2nd. When examined at autopsy on March 7th, both of these tests animals were found to be tuberculous.

"The tubercle bacilli in both instances were similar in appearance and were composed mainly of individuals of medium, long and in some cases slightly curved formation, but experiments were not made to determine other characteristics which would justify their definite classification into the human type.

"'Masher's Repose' immunized showed a suspicious supra-mammary gland, but tubercle bacilli were not demonstrable microscopically or through the inoculation of guinea pigs.

"'Proda's Sultana 2nd' immunized, showed hemorrhagic bronchial glands.

"'Dewey's Ship,' immunized showed slight calcified areas in a sub-lumbar gland.

"'All carcasses were passed for food."

The animal Turby which showed no microscopical lesions, though the suspected material from the supra-mammary gland when injected into guinea pigs was capable of producing generalized tuberculosis, was given her first dose of tuberculosis vaccine March 7, 1909 and four subsequent doses between the time mentioned and January 27, 1910. During this time she was allowed to mingle with the other members of the herd which were believed not to be infected. However, the test of 1910 showed that the herd contained affected animals, and it is probable that this particular animal may have become infected during this time, inasmuch as it is known that an animal has less resistance for a short time (4 to 6 weeks) following the vaccination than normal.

In the case of the second immunized animal, Dewey's Ship, another explanation can be offered. This animal was first vaccinated against tuberculosis on January 30, 1905 and received three vaccinations ending June 15th, 1905, and it is within reason to believe, with the knowledge at hand, that the immunity conveyed by the vaccine had been lost in this length of time.

To briefly summarize the results obtained by the application of the tuberculin test, I herewith give the following table:

	Percentage.
1904,	26.2
1905	
June,	10.8
November,	5.1
1906	
April,	8.4
November,	3.6
1907	
April,	0.
1907	
October,	0.
1908	
April,	1.4
November,	1.8
1909	
April,	0.
1910	
May,	3.3
1911	
January,	2.5

It is of interest to know that during a part of the period above mentioned, two bulls which had reacted to the tuberculin test but showed no clinical evidence of tuberculosis, were used for breeding purposes in connection with cows in the main milking herd. This was done in order to obtain the offspring, as the bulls in question were considered to be of the best Guernsey blood in this country. Both animals during their period of service were kept by themselves, entirely separate from the herd, in a specially constructed barn allowing plenty of light and ventilation, with a large exercising yard enclosed by a plank fence 5 feet high. The following rules were carefully observed in the care of these animals as well as in breeding cows to them:—

I. The animal is at all times to be kept well isolated from the main herd in a specially constructed stable and is to be attended by an employee who has no connection with the other cattle.

II. All utensils used in his care such as buckets, brooms, forks, halters, feeding boxes, brushes, currycombs, etc., are under no conditions to be removed from his stable and taken to to another stable unless they are thoroughly cleansed and disinfected with a 5 per cent. solution of creoline or carbolic acid.

III. He is to have a special halter and lead pole that must never be used for any other animal.

VI. A special place preferably close to his stable should be selected for service, and no circumstances should permit him to be taken into the yards or stables of the main herd.

V. After a cow has been served by him they should be separated at once and the cow sponged with a 3 per cent. solution of creoline or carbolic acid *before* being returned to the main stable.

After 18 months or more of service it was noticed that these bulls began to lose flesh and exhibit other symptoms indicating the advancement of the disease. Their use as sires was discontinued, and later, they were killed, and upon autopsy, showed generalized lesions of tuberculosis. Even though precautions were taken to prevent these animals from endangering the herd, it is possible that they may have been partially responsible for a percentage of the reactions obtained.

It seems unfortunate that this herd should have been freed from tuberculosis twice and as many times reinfected. However, I do not believe that it is possible to keep a herd entirely free from tuberculosis in which new animals are being constantly purchased and entered into the herd upon the tuberculin test at the time of purchase. After a herd has been gotten free of tuberculosis the best manner to keep from reinfecting the same is to endeavor to raise all animals needed for future milkers, from the tuberculous free cows on the farm.

We shall now consider the second phrase of this problem, namely, the value of the immunization of the young calves intended for future members of the herd by the use of tuberculosis vaccine.

The vaccine consists of tubercle bacilli of the human type which have been found to be non-virulent for cattle, suspended in normal saline solution. The particular culture known as Culture M, used in the herd referred to was obtained from the sputum of a young girl. The sputum upon miscroscopical examination contained vast numbers of tubercle bacilli. Each microscopic field showed fifty to one hundred bacilli. There did not appear to be any extensive pulmonary tuberculous process upon clinical examination. The culture was isolated in 1901 and its virulence was carefully tested upon guinea pigs, rabbits, calves, sheep and horses. It was found if given in larger quantities to bovine animals it was incapable of producing lesions of tuberculosis. These injections were made subcutaneously, intraperitoneally and intravenously.

The suspension of the tubercle bacilli in the salt solution used for the vaccination work was made so that 1 cc. of the suspension represented 1 milligram of dried tubercle bacilli. Fresh cultures were used and no vaccine was prepared more than thirty-six hours prior to injection. The vaccine was injected directly into the jugular vein.

During the years 1904, 1905 and 1907 it was the policy to give the calf the first vaccination when three to four weeks of age and subsequent vaccinations at intervals of four to five weeks. Since 1907 the calves have been taken away from their dams soon after birth and placed in a stable specially constructed for their care and which can easily be disinfected at any time. Believing that there was *no* danger of the calves contracting tuberculosis while kept in this stable and fed upon pasteurized milk, the initial vaccination was not given until the animal had attained the age of at least eight to ten weeks. The interval between subsequent vaccinations was also lengthened.

Dr. Leonard Pearson and the writer discovered about this time that it was important if one wanted to obtain success in increasing the resistance of cattle against tuberculosis, to keep the animals during and for not less than six months following the last vaccination in a manner in which there would be no possible chance of infection. It appears that the normal resistance of an animal is lowered during the period of vaccination.

During the year 1904 there were thirty-two calves vaccinated with vaccine prepared after the method above outlined. The number of doses given was three, the first consisting of 2½ cc., the second of 4½cc., and the third 7½ cc. After the third vaccination was completed these calves were turned to pasture and contracted lung worms (strongylus micrurus or plubmonalis) and twelve of them died from the same. There are six of these animals in the herd at the present time and the remaining number have either been sold as milch cows or slaughtered for beef, owing to the fact that they did not produce a sufficient number of pounds of milk yearly to warrant keeping them in the herd. It has been the policy of this farm to have a standard number of pounds of milk for each breed and if the animal falls below this standard during a period of lactation it is disposed of to the butcher.

In 1905 there were forty-two calves vacccinated, each animal receiving four vaccinations; the initial dose being 1 cc., the second dose 2½ cc., the third dose 5 cc., and the fourth dose 7½ cc. Six of these animals are in the herd at the present time. The others have been disposed of either for beef or sold to other parties for dairy purposes.

For the year 1906 the records show that thirty-eight animals were vaccinated receiving three vaccinations, the dosage consisting of one, three and five cc. respectively and extending over a period from May 14 until September 5th. Of the number vaccinated during this year there are six remaining in the herd.

Twenty-two animals were vaccinated in the year 1907, the majority of which received four vaccinations, over a period from October 23, 1907 to March 23, 1908. The doses consisted of 1 cc., 2½ cc., 4 cc. and 6 cc. Two of these animals received but three vaccinations and three animals received but two vaccinations. Of the twenty-two animals vaccinated there are eight in the milking herd.

During the years 1908 and 1909 there were fifty animals vaccinated, forty-one of which were given ten vaccinations, covering a period of approximately one year's time. The increased number of vaccinations were given in order that another experiment could be started to determine whether the milk of animals hyper-immunized had any protective value against tuberculosis. This experiment is under progress at the present time and the results will be published at a later date. The remaining nine animals vaccinated during the two years above mentioned, received four vaccinations covering a period of six months. All of these animals are still members of the herd except five which have either been sold or slaughtered for meat purposes.

Only one-half of these animals have given birth to their first calf and are members of the milking herd, though they are kept in a separate stable some distance from the main barn, owing to the fact that they have not lost their sensitiveness to tuberculin and will react

if injected with a regular dose of the same. It is the owner's desire to have his main milking herd known as one that contains no tuberculin reacting animals. This is also a regulation of some of the larger cities in which the milk is sold.

To briefly summarize, we find that since 1904 we have vaccinated 184 calves, of which forty-six are in the main milking herd at the present time. Of the 143 animals that were sold for breeding purposes, for beef or that died from lung worms, etc., post-mortem examinations were obtained on approximately 100 head and no lesions of tuberculosis were found in any except those aformentioned following the tuberculin test of 1911.

There were no calves vaccinated that were born in the year 1910 and 1911, as most of these calves the owner desired to sell to parties in either his own State or in other states. It has been found that animals receiving tuberculosis vaccine will react to tuberculin for a certain length of time following the final vaccination. This reaction to tuberculin interferes with interstate shipments and for this reason the vaccinations were discontinued for the period aforementioned, but it is my intention to vaccinate all calves this Fall that have been born during the summer months and are desired for future members of the herd. This decision has been brought about by the fact a few months ago a lot of fourteen calves that were stabled in a barn which had been previously used to keep reacting animals in, seemed to be unthrifty. One of these calves died from some unknown cause, and upon postmortem examination a suspicious lymphatic gland was found. Upon section it showed no distinct tubercle formation but was sent to John Hopkins University for miscroscopic examination and tubercle bacilli were found in the smears made from the same. This stable before the calves were placed therein had been thoroughly disinfected. In order to determine the extent of infection of this los of animals, six of the others were killed after having given positive tuberculin reactions, and upon autopsy showed incipient active foci of tuberculosis. These animals had not received any tuberculosis vaccine. The remaining animals of this lot which did not react to tuberculin will be carefully watched and not allowed to mingle with other members of the herd until they have given another negative tuberculin test.

It is of interest to know that this particular lot of calves were taken care of by the same party who had charge of the two cows aforementioned, that is Proceda and Francelmar which were killed upon physical examination. This may have been the source of infection of this lot of calves.

It is my belief that if these animals had been vaccinated with tuberculosis vaccine within eight or ten weeks following their birth, they would have had sufficient resistance to withstand the slight infection to which they were subsequently exposed.

Vaccinated animals have been tuberculin tested at intervals of one month from the third month to the twenty-fourth month following the final vaccinations in order to determine at what period they lose their sensitiveness to tuberculin. The time when the sensitiveness is lost has been found to be rather irregular, varying from six months to nineteen months. It is my belief, however, that the sensitiveness

to tuberculin has any relation to the degree of immunity that the animal may have against tuberculosis.

We come now to consider the animals which had reacted to the tuberculin test and were considered to be of sufficient value to be placed upon the Bang system with the main object of saving their offspring. From the reacting animals in 1904, twenty-four cows, heifers and bulls were saved. In 1905 there were eleven animals reserved for this purpose.

These animals were thoroughly isolated from the main milking herd, attended by one man and the milk was adequately pasteurized before being used for any purpose.

In 1904 Dr. Leonard Pearson and the writer published an article entitled, "The Effect of Tuberculosis Vaccination upon Cattle Infected with Tuberculosis." The experiment was made upon twelve yearlings of the Shorthorn breed. The animals were approximately the same age and size and had, just prior to the starting of the experiment, reacted to the tuberculin test. It was believed that the lesions they contained were not far advanced and they would be good subjects for such work. In conclusion, the article states: "we believe we have sufficient evidence to justify the statement that the treatment to which six of the animals were subjected had the effect of not only keeping in check the progress of a tuberculous process but in causing a distinct and in some cases a great retrogression of the lesions. In other words the treatment had a distinct curative effect." With this knowledge at hand, it was decided to keep the valuable reacting animals of this herd, isolate and handle them in accordance with the Bang system, as well as to treat them with tuberculosis vaccine and tuberculin.

They were first given an intravenous injection of tuberculosis vaccine. The dose depended upon the age, size and physical condition of the animal and ranged from 4cc. to 10 cc. of a standard suspension of tubercle bacilli of the human type. This was followed at intervals of seven days with increasing doses of tuberculin until three injections were given. Then a second injection of tuberculosis vaccine, the dosage being the same as the initial injection, was given. This was followed by three weekly injections of tuberculin, increasing the dose with each injection. Finally, a third dose of tuberculosis vaccine was given followed by weekly injections of tuberculin, increasing the dosage at each injection until the animal ceased to react.

I regret very much that I do not have a complete record of the offspring of these animals, but I feel safe from the information I have at hand to state that fifty per cent. of all calves were saved. The plan was to remove the calf from the infected stable as soon as dropped, sponge it thoroughly with a solution of creolin, remove it to non-infected quarters and to feed it artifically upon pasteurized or sterilized milk. In some of the animals the treatment seemed to have no beneficial results, while in others most encouraging results were obtained. These animals were slaughtered at various times throughout the experiment, the last being killed April 19, 1907. In eight animals of the thirty-five animals in the experiment no microscopical lesions of tuberculosis could be determined after a careful postmortem examination. In ten of the remaining animals, only

small calcareous lesions could be found. These were well encysted with a thick, hard, grayish, fibrous wall. The best results were obtained in those animals in which the initial lesion was small and inactive at the time the treatment was begun.

In conclusion, it is my belief where a herd that contains valuable animals, both for breeding and dairy purposes, and in which there is over 8 per cent. of tuberculosis, the disease can be most easily and economically eliminated by applying the tuberculin test every six months combined with the use of tuberculosis vaccine and the Bang system, for reactors from which it is desired to save the offspring.

The use of tuberculosis vaccine has not as yet reached a practical stage and must remain in the hands of laboratory workers until more knowledge is obtained upon anaphylaxis, duration of immunity and the tuberculin test upon vaccinated animals.

To free a herd from tuberculosis it is necessary to have a quarantine barn for all newly purchased animals and to keep the same therein for a period of not less than three months before placing them with the main milking herd.

Before closing, I desire to acknowledge the valuable suggestions and advice given me by Dr. Leonard Pearson, who at all times was willing to assist me in every way possible. Further, I desire to express my thanks to Dr. E. S. Deubler and to Dr. E. L. Cornman for general assistance in making the tuberculin tests and the vaccinations of the young calves. I beg to acknowledge much assistance rendered me by Dr. F. A. Mackie and Dr. W. L. Moss in postmortem examinations. I am also greatly indebted to the owner for his ready cooperation with all suggestions given, without which it would have been impossible to have continued this work.

During the year, the following well written paper was prepared by Dr. John Reichel, Chief of the Laboratory. It deals with the subject of rabies, which, at this time, is one of great importance to every one within the Commonwealth of Pennsylvania. It is written in such a manner that it can be understood by both the layman and scientific man, and gives valuable advice upon this subject:

THE DIAGNOSIS OF RABIES

By JOHN REICHEL, V. M. D., Chief of the Laboratory of the Pennsylvania Livestock Sanitary Board.

INTRODUCTION

The terms rabies, lyssa, canine madness or hydrophobia, are applied to a specific disease to which all warm blooded animals are more or less susceptible. All of the terms, except hydrophobia, are appropriately applied to the disease in dogs and the lower animals in which the sum total of the usual symptoms at time is an expression of rage, madness or rabid condition. The dread of water as a

symptom of the disease is expressed in the term hydrophobia, and as this symptom is not seen in animals, but in men, the appropriateness of the term of the disease in man it at once apparent.

Late in the eighteenth century, a highly acute and fatal disease among dogs of Massachusetts, near Boston, was recognized as rabies, and before the close of that century, rabies was also recognized in Pennsylvania. Since then it has been a matter of interest to note the spread of the disease from the East to the West, which has been most rapid during the last two decades, and the disease is now known to exist in every state in the Union. In the Eastern states, particularly New York and Pennsylvania, the disease has taken the proportions of alarming epizootics within the past two years.

Infection, under natural conditions, usually occurs following the bite of an infected animal, the saliva containing the specific cause or virus. Experimental transmission may be successfully accomplished by the injection of the portion of the brain tissue, spinal cord, saliva, lachrymal secretion, pancreatic secretion or milk of an animal with rabies. From the results of the inoculation of such material, it has been shown that the virus is present in the brain and spinal cord in its purest form and more constant in those tissues than in the saliva or the other secretions. Accidental inoculation with the subsequent development of the disease may follow the penetration of slight and superficial wounds with saliva, etc., containing the virus. Symptoms do not immediately follow the bite of a rabid animal or injection of virus, but as in all infectious diseases, particularly those caused by protozoa, there is a period during which nothing unusual is observed. This period of incubation, i. e., from the time of infection to the beginning of symptoms, varies in the different animals, depending upon the virulence of the virus, dose, seat of inoculation and susceptibility of the victim. The symptoms in the majority of cases are slow in developing, and as a rule an animal when attracting attention has shown symptoms for many hours, and not infrequently for a day or two. In that infected animals may show symptoms of the disease one or two days before the symptoms attract attention, the question naturally arises, how long before actual or noticeable symptions is it possible for an animal developing rabies to transmit the disease by means of a bite or otherwise? Nocard and Roux have both shown by experiment that the saliva of a dog is infectious at least three days before the dog shows symptoms of rabies, while in experiments conducted by the Athens (Greece) Pasteur Institute, the virus was demonstrated in the saliva eight days before the dog showed signs of the disease[1]. This conclusively demonstrates that the saliva may carry the cause of rabies, and that the presence of the virus may be demonstrated in the saliva before the animal shows premonitory or actual symptoms.

In establishing a diagnosis, the history, symptoms, gross autopsy findings and laboratory examination are all of importance, but are not all absolutely necessary in any one case, as at times a clear history of the animal having been bitten some weeks previous by a rabid animal, and subsequent development of the characteristic symptoms following a period of incubation, may be sufficient for an accurate diagnosis. Then again, the symptoms and gross autopsy findings, without any history may be conclusive enough to suggest the

possibility of the existence of rabies; and in such a case, the laboratory examination should be relied upon as well as in those cases in which the history and autopsy findings without the symptoms fail to be conclusive.

THE USUAL HISTORY

The dog has for centuries been known to be the real carrier and most frequently afflicted of all the warm blooded animals. The often repeated statement credited to Aristotle, who lived from 284 to 322 B. C., "Of these, Lyssa (rabies) causes mania, and whatever is bitten, of these bitten go mad except man"[2] is taken as evidence that rabies existed before the beginning of the Christian era, and strengthens the belief that dogs suffered from madness. Unfortunately, the observations of Aristotle were not thorough enough to note the transmission of the disease from dogs to man. In Russia, the wolves are credited with harboring and spreading the disease. The dog and wolf are not any more susceptible to the disease than are other warm blooded animals, but the dog through freedom allowed him and his habit of exchanging greetings and joining in combat with his kind and other species, exposes himself to the chances of infection. The popular belief that dogs are more apt to go mad or develop rabies in Summer, particularly during the so-called "dog days"—the time of the year from July 3, to August 11, when the "dog star," Sirus, is above the horizon with the sun—is not corroborated in referring to Table No. 1, in which it may be seen that during July and August the number of heads of animals suspected of having rabies received at the laboratory was not as large as in many of the other months during 1900 to 1909, inclusive.

The largest number of heads were received during the months of November and December. As it is a fact that dogs do mingle more in warm weather, therefore, they are more exposed and should infection take place, with its subsequent period of incubation of 4-8 weeks before symptoms develop, the apparent increase in the number of heads during the months of November and December may be accounted for. With the spread and increasing prevalence of rabies, it must be recognized that dogs permitted to run at large, even for short periods at a time, may while at liberty, be exposed to a rabid animal. The owner of a suspected animal will not infrequently insist that this or that animal was not exposed; but in almost every instance, some loophole in the confinement of the closest of pets can be discovered. It is well known how eagerly dogs, seldom permitted to run at large, join other dogs when granted that freedom, thereby increasing the chances of exposure in arousing a passing or sulking rabid dog. In gathering the history, an attempt should be made to find out the day of exposure or time of infection. Not infrequently, as proof of exposure, a healing wound, the result of a bite may be detected on some part of the body.

The period of incubation of rabies in the domestic animals including man is usually within the following number of days:

Man—14 to 90 days.
Dogs—14 to 60 days, authentic exception 365 days (3)
Cats—14 to 60 days.
Cows—14 to 80 days.

Horses—21 to 90 days.
Swine, sheep & goats—21 to 60 days.
Birds—14 to 60 days.
Rabbits—9 to 90 days.
Guinea pigs—8 to 60 days.

It is an exceedingly rare occurrence for men or any of the lower animals to develop rabies following the 100th day from the time of exposure or infection, but there are rare instances in which exceptionally long periods of incubation have been observed.

SYMPTOMS

A careful study of the symptoms of rabies in the dog is of the greatest importance in attempting an antemortem diagnosis. The disease is acute in its course, and when symptoms are pronounced, death usually follows in a very high percentage of cases within several days. Pasteur, Rous and Babes are on record as having seen rabies in the dog with recovery after well marked symptoms had developed. These instances are exceedingly rare and should not detract from the general opinion that rabies is always fatal. In a careful observation of a large number of dogs suspected of having rabies, sent to the Veterinary Hospital of the School of Veterinary Medicine of the University of Pennsylvania during 1906-1909, inclusive, not one dog lived more than eight days with symptoms of the disease.

The types or forms of rabies are usually recognized—the furious or irritable types are not sharply defined nor always separable. They are more correctly considered as stages of the disease because both are preceded by identical premonitory symptoms. The furious stage is usually followed by the paralytic stage; but not infrequently the paralytic stage may follow the premonitory symptoms with the omission of the furious stage.

PREMONITORY SYMPTOMS

First, a decided change in the disposition of the animal is observed. A lively and amiable dog may suddenly become dull; the quiet and unexcitable dog may become unusually alert, more affectionate, demonstrative and exhibit the desire to be caressed. A dog not in the habit of barking, may bark frequently without any apparent reason and seem unduly disturbed without cause. The appetite is good and even excessive, and perhaps the animal may eat food as a rule not enjoyed. The increased friendliness is most striking, and other changes in the disposition may be detected. These symptoms may suddenly become more alarming, as the furious stage succeeds the premonitory symptoms, or the dog may seek quiet surroundings with the development of the paralytic or dumb stage.

FURIOUS STAGE

The dog is increasingly restless. The muscles are firmer and more tense, particularly those of the limbs and back. He responds to the owner's call, but not quietly. The impression is that the dog has

some trouble in locating the owner, but recognizes the voice as in health. Coakley has called attention to a symptom he considers pathognomonic, a fixiation of the pupil of the eyes. In dogs confined in well lighted cages, the contracted pupil does not appear to be a constant symptom, and not infrequently one pupil is seen much contracted and the other not at all affected, or even dilated. The eyes do appear to be somewhat limited in their movements, and along with the muscle firmness, there is a glary fixed expression. At this time it may be noticed that the dog is lapping seemingly exerts himself more than usual in attempting to drink water. The water when taken into the mouth mixes with the saliva and the constant movements of the jaw and tongue form a froth. The desire to drink appears to be increased, which is quite natural with the inability to swallow, owing to a gradual and progressive paralysis of the muscles of the pharynx. The paralysis later extends to the jaw and tongue. With the paralysis well advanced, the dog is not capable of swallowing, but the desire and attempt to quench the thirst does not abate. The dog will repeatedly plunge his nose into water and make a strenuous attempt to swallow, which at first only causes an increase in the flow of saliva with the formation of more froth. The druelling giving rise to the symptoms popularly known as "frothing at the mouth." Before the paralysis is complete the appetite becomes decidely depraved, which is another characteristic symptom as seen—the destruction and attempt to swallow straw, coal, wood or other foreign material. As paralysis of the pharynx progresses, a significant change in the bark occurs, which is one of the most constant symptoms of rabies in the dog. Occasionally a dog will not bark and nothing will induce him to do so, although he may show all of the other symptoms of the furious stage. The bark in the premonitory stage may be the same as in health, but with the development of the furious stage, the bark is decidely changed. Instead of a sharp and clear bark, the latter part of the note becomes prolonged and of a higher pitch. The inability to swallow is due to a progressive paralysis of the pharynx. This condition has often been mistaken for symptoms observed when a bone or other foreign body lodges in the throat, and has led many a sympathizer to investigate and thereby expose himself to possible infection. With the progress of the disease, the dog will start out and travel tremendous distances if unhindered. Wide rivers have been successfully crossed. There appears to be one desire uppermost within the beast, to go on and on. It is the rule that an attempt will be made to return home or to go to the original starting place. The appearance of the animal upon his return is worthy of mention. Emaciation is marked; wounds and blood mixed with foreign matter cover the body; the eyes are clouded and expressionless; the mouth is open owing to paralysis of the lower jaw; the tongue hangs loose and usually discolored; the mucous membrane is dry and the lips on the sides of both lower and upper jaws lie in close, changing the general appearance of the dog at times beyond recognition. The change in appearance is a striking one and is as characteristic as the alteration of the bark. Paralysis of the hind limbs rapidly extends forward, and it is a race between the progressive paralysis and death, whether or not the paralysis will extend to the front

limbs and then to the head before death. With the complete paralysis of the limbs and head, the only perceptible signs of life are the movements of respiration. Death usually follows quickly. The onset of the general paralysis is usually considered the beginning of the paralytic or dumb stage of rabies.

PARALYTIC OR DUMB STAGE

Following the change in the disposition, it may be observed that the dog is in search of a secluded and dark place. He is apt to crawl beneath furniture or furnishings of house or barn, and if not disturbed, die there. Paralysis is the predominating symptom in the paralytic or dumb satge, and as a rule first involving the muscles of the pharynx, then the muscles of the face, causing the lower jaw to hang and the mouth to remain open. Drowsiness rapidly overtakes the animal, and it is difficult and often impossible to arouse him. The paralysis rapidly progresses and death usually follows within two or three days. The usual position of the dog at death is curled up as though asleep. The course of the disease after symptoms have developed is rapid, from two to eight days. Therefore, if any dog thought to be showing symptoms of rabies is alive at the end of eight days without any noticeable change in the symptoms shown, it is not likely that rabies exists.

The symptoms in man, cow, horse, cat, hog, sheep, goat, deer, rabbit and guinea pig may also be described under the stages, of premonitory, furious and paralytic, varying considerably in the different species.

GROSS APPEARANCE AFTER DEATH

The morbid anatomy of rabies is limited, as there are no gross changes that are constant or specific of the disease. With the natural death of a rabid animal, the general condition of the body is one of emaciation. Wounds healed and recently inflicted may be found. The eyes are usually covered with mucous or foreign material. The mucous membrane of the mouth may be dry, discolored, blue to black. Where an animal is destroyed during the first stage, the mucous membrane may be excessively moist, the saliva mixed with air may be seen as froth hanging from the lips. The mucous membrane of the pharynx, oesphagus and stomach may be reddened. In the stomach the presence of foreign bodies may be accepted as an indication of a depraved appetite, which should strengthen the suspicion of rabies. The intestines invariably contain but a scant amount of material. The internal organs are apparently normal but slight secondary changes may be present, such as bronchitis, developing catarrhal pneumonia or small hemorrhagic foci here and there, etc. The meninges of the brain and spinal cord may or may not be congested. The absence of any gross changes should strengthen the suspicion of rabies.

LABORATORY EXAMINATION

The importance of an accurate diagnosis made as quickly as possible is well known. In many instances, the history, symptoms and gross appearance at autopsy are not conclusive or as is most fre-

quently the case, they are highly suggestive of the existence of rabies and a laboratory examination must be resorted to. As the laboratory examination is limited to the brain, nerve ganglion and upper portion of the spinal cord, it is sufficient to submit to the laboratory the dog's head and neck cut off close to the shoulders. In shooting an animal through the head, the portion of the brain tissue usually examined is apt to be destroyed and, therefore, it is recommended that an animal be shot through the heart or destroyed with chloroform or strychnin. Of the large animals, horse, cow, hog, etc., the brain may be removed and sent more conveniently and with less expense. Rapid decomposition is prevented when the specimen is wrapped in paper or cloth and packed in a metal can or box surrounded with ice in a shipping box. A metal or wooden bucket containing the specimen wrapped in paper or cloth is considerably used, and serves the purpose well. Glycerin has long been known to have little effect on the virus of rabies and experimental animals may be successfully inoculated with brain tissue immersed in glycerin for months, and as the microscopic examination of the tissue is not much interferred with, in glycerin immersed specimens, the specimens sent to the laboratory in glycerin (water and glycerin equal parts frequently used) are almost as desirable as the fresh specimens.

ANIMAL INOCULATION TEST

To reproduce rabies with material suspected of containing the virus is absolute proof of its existence in the material. It is well known that the saliva carries the infectious material or virus. Proof of this lies in the manner in which the disease is transmitted, under natural conditions, through the bite of an animal with rabies, the saliva being the only material left behind as the bite is inflicted. In the work of Pasteur, in the general study of the disease, he found that of experimental animals inoculated with saliva containing the virus, a large percentage not only failed to develop the disease, but also that the period of incubation in those that developed symptoms and died was very uncertain. Sound experimental work was therefore impossible until a trustworthy method was found whereby the disease could be reproduced in a high percentage of all the experimental animals inoculated with material containing the virus. Thus, Pasteur was led to use emulsions of spinal cord or brain tissue and it was found that the virus in these structures was least liable to be contaminated, more constant and probably in a more concentrated form. The various ways of injecting the virus show that the seat of injection influences not only the percentage of mortality, but also the length of the period of incubation and, therefore, cutaneous injections or infection through a wound in the skin, subcutaneous, intraperitoneal, intramuscular and intravenous injections were tried and still the percentage of animals that would not develop rabies was too large and the period of incubation too varied to consider the results uniform. The best results were not obtained until the distance from the point of injection to the spinal cord or brain tissue, particularly the last named structure, was reduced to a minimum, by injecting material containing the virus directly over the brain or spinal cord, beneath the meninges—subdurally. As a means

to demonstrate the presence of the virus, rabbits are generally used. Subdural injections are easily made without any pain to the experimental animal. A 2 per cent. cocaine solution is usually injected subcutaneously over the forehead as a local anesthetic. An incision is made parallel to the long axis of the head, less than 2 c. m. long, a little to one side of the medium line, through the skin and periosteum over the frontal bone. The soft tissues are spread apart and a small hole is drilled through the bone or preferably a small trephine is used and a disc of bone is removed about 0.5 cm. in diameter. The point of a syringe needle through which the emulsion containing the virus is forced from a syringe is inserted through the meninges and several drops of the emulsion is injected over the brain. A curved hypodermic needle (Pravaz) attached to a Roux syringe is preferred. The emulsion is usually made with a piece of brain tissue, diluted with twice its volume of sterile normal salien solution. Of 117 rabits so inoculated with brain tissue containing the virus of heads sent to the laboratory during 1905 and 1909 inclusive, 107 (91.3 per cent.) died of rabies on an average of 25.3 days, one in nine days and one as 134 days after the inoculation. These figures do not represent the length of the period of incubation, in that none of the rabbits were kept so as to observe the onset of the first symptoms. The period of incubation is, therefore, shorter by at least 4 days, which would make the period twenty-one days on an average. Several unusually long periods from the time of injection to death were observed among rabits included in the 107, of these 66, 85, 110 and 134 days were the longest. Ten (9.7 per cent.) of the 117 rabbits resisted infection. It is the general experience that every now and then a rabbit will resist infection, and for this reason two rabbits are usually inoculated. The mate of each of those that resisted infection died of rabies. For a rabbit to develop rabies 100 days or more after inoculation is execeptional, and it is entirely safe to assume that the virus was not in the suspected material inoculated, or that rabies did not exist if both rabbits are alive at the end of 100 days. In the routine diagnosis of specimens received at the laboratory of the Pennsylvania State Livestock Sanitary Board during 1905 and 1909 inclusive, 313 rabbits were inoculated subdurally; 107 of which developed rabies; 206 failed to give any positive proof of the existence of rabies; of these 129 outlived the 100 days allotted; 53 died of unknown causes; 18 died of septicemia; 3 of cerebral hemorrhage; 2 of coccidiosis and 2 of enteritis.

Wilson of the New York Board of Health (1898) was the first to use guinea pigs in the place of rabbits, as the period of incubation in these animals is shorter than in rabbits. Of 36 guinea pigs dead of rabies in our laboratory, the average period from the time of injection to death was 15.6 days; shortest period 8 days; longest period 24 days. The actual period of incubation would necessarily be a trifle less. Arms [5], from a large number of guinea pigs kept under observation, estimates that 1.69 days longer is required for death to take place following the appearance of the earliest symptoms, which would place the average period of incubation at a trifle less than 14 days for guinea pigs.

MICROSCOPIC EXAMINATION

The distinct changes in the cellular structures of the verebral hemispheres, cerebellum, spinal cord and nerve ganglion accompanying the development of rabies were pointed out in the early seventies, but Babes in 1892 was the first to search for these tissue changes in animals dead of rabies to assist in the establishment of a diagnosis. He held that it was possible to make a rapid diagnosis by a microscopic examination of the medulla oblongata and spinal cord, describing the cellular accumulation in these structures under the name of "rabic tubercle." Following the discovery of the "rabic tubercle" by Babes, Nelis in the laboratory of Van Gehuchten, found changes in the spinal cord and gangion of two human beings dead of rabies. Ravenel and McCarthy[6] emphasized the diagnostic importance of these tissue changes in 1900, and expressed themselves of the opinion that the examination of the ganglion in the dog for the changes described by Van Gehuchten and Nelis afforded an accurate means to a rapid diagnosis of rabies. These changes pointed out by Van Gehuchten and Nelis in the ganglion and those of Babes in the medulla oblongata and spinal cord are the result of the influence of something thrown off by the cause or virus of rabies upon the virus of rabies upon the endothelial cells and nerve cells of these structures, directly or indirectly. The andothelial cells forming the walls of the cappillaries and the single layer of the endothelial cells which make up the lympth sacs surrounding the larger nerve cells of the spinal cord and those of the nerve ganglion are chiefly involved. These cells are apparently stimulated to proliferate and the increase in the cells causes a thickening of the walls of the capillaries and lymph sacs. Along with these endothelial changes, slightly in advance, the nerve cells undergo degenerative changes—shrinkage, chromatolyses and as the endothelial cells crowd in upon and over the nerve cells, complete destruction of the nerve cell is the result. (See plate III). Crocq followed by Spiller[7], was among the first to show that endothelial cell proliferation with nerve cell degeneration and destruction is seen in some conditions, without the existence of rabies. This has been the experience of others and the writer in the study of forage poisoning or cerebro-spinal meningitis of horses has seen typical "rabic tubercles" in the medulla oblongata, and in several dogs with distemper, endothelial cell proliferation changes were found in the ganglion.

In 1905 to 1909 inclusive, sections of the medulla oblongata and ganglion, including one of the sympathetic ganglion and pleviform ganglion of the pneumo-gastric nerve were examined for proliferation changes with the following results:

	251 Positive Cases.	86 Negative Cases.
Medulla Oblongata, 337,	180 (71.7%)+*	80 (93.0%)—
(Babes Proliferation Changes),	69 (27.5%)—	5 (5.8%)—
	2 (0.8%)S	1 (1.1%)S

	171 Positive Cases.	71 Negative Cases.
Sympathetic ganglion, 242,	139 (77.6%)+	66 (92.9%)—
(Van Hehuchten and Nelis),	30 (16.0%)—	3 (4.2%)+
(Proliferation Changes),	2 (5.8%)S	2 (1.1%)S

	360 Positive Cases.	108 Negative Cases.
Plexiform Ganglion, 468,	357 (99.1%)+	71 (65.7%(—
	0 (0 %)—	14 (12.9%)+
	3 (00.8%)S	23 (21.2%)S

*+=Positive. —=Negative. S=Suspicious.

Babes "rabic tubercle" were not seen in 27.5 per cent. of the sections of the Medulla oblongata examined from animals with rabies and in 5.8 per cent "rabic tubercles" were demonstrated in the medulla oblongata of dogs proven to have been free of rabies. The changes of Van Gehuchten and Nelis in the sympathetic ganglion were seen in 77.6 per cent. of the actual cases of rabies, and in 4.2 per cent. of the ganglion of animals free of rabies. The changes in the plexiform ganglion of the positive cases were found in 99.1 per cent., and in not a single instance of all the cases considered rabid did these ganglionic changes fail to show themselves. That similar changes are seen in the plexiform ganglion of animals not rabid is shown in that in 12.9 per cent. of the negative cases similar changes were found. The changes in the plexiform ganglion are better developed the longer the animal is permitted to live after beginning to show symptoms of rabies.

NEGRI BODIES

The bodies demonstrated by Prof. Adelchi Negri of Pavia University in 1903 in the nerve cells of the brain and spinal cord of animals dead of rabies and known as Negri bodies, are now held of the highest value in the diagnosis of rabies, and the bodies are looked upon as the probable cause of rabies. They have as yet not been demonstrated in any other diseases. Bodies such as vacoules and granules are seen in the nerve cells of the normal animal or in those dead of one cause or another but these bodies cannot be mistaken for the Negri body which has definite morphological character-

istics. They are oval or rounded in form and in size vary from exceedingly minute to the largest approaching 25 microns in diameter or length (see Plate IV). Those usually seen in the brain of the dog of the street vary in size from barely visible forms to eight microns in diameter, rarely more. The smallest form are seen in rabbits dead from an injection of "fixed virus," and most extraordinarily large forms are seen in the cow dead of rabies. Negri bodies have distinct staining affinities as they favor the basic stains over the acid. Within the body small, usually rounded but frequently irregularly shaped inner bodies are seen that favor most all of the chromatin stains, characteristic of nuclear material. With the stains now in general use, these inner bodies take a blue to a black color, the intensity varying with their size. The smaller the inner bodies, the deeper the stain, while the rest of the body takes a light stain, a purple to a pink, or various shades of red. The contrast is at once striking, and these inner bodies encourage attention. The inner bodies may be seen as a single body, which is true of those tiny forms seen in the rabbit, and around these tiny forms, other granular material can be seen. The next larger forms show no appreciable enlargement of the inner body. Usually in the Negri body showing considerable granular material around the inner body, the inner body is apt to be noticeably larger and not stained as deeply as the inner body of the tiny forms. Then too, in the larger forms, not infrequently several inner bodies are seen lying close to one another, but each small and deeply stained. Forms showing larger inner bodies not so deeply stained are seen, and in addition several smaller deeper stained inner bodies may either lie close to the larger inner body or out in the structure around the inner body. Another form of much interest is the one in which the inner bodies are scattered through the Negri body, all fairly deeply stained. Not infrequently a form in which these separate inner bodies stain rather deeply scattered through the body, stand out prominently appearing to be pushing out the outline of the Negri body, strongly suggesting pseudopods or budding forms. Of the protozoa, the ameba or rhizapods and sporozoa, exceedingly varied and complicated life cycles are recognized. In one stage of the development of these protozos, additional chromatin material makes its appearance within the cellular structure, either by a reduction of the chromatin of the nucleus or by the elaboration of chromatin by the cytoplasm, the result of some special stimulus affecting the nucleus or cell protoplasm. The chromatin bodies are distributed through the cytoplasm, and these chromidial forms form a distinct phase in the development of these protozoa. The inner bodies of the Negri bodies, as chromatin or nuclear material, occasionally show an arrangement or stage resembling this chromidial stage of the rhizapods and aporozoa. The position taken by Williams and Lowden[8] in considering the Negri bodies as protozoa and by Calkins[9] that they are one of the ameba or rhizapods is well founded, on the study of the various forms of the bodies met with. The protozoon nature of the cause of rabies receives additional support in that quinine will neutralize the virus in test tubes.

That Negri bodies are closely associated with the cause of rabies has been proven by the uniformity with which it is possible to re-

produce the disease with material in which the bodies are demonstrated. They have been found in the larger nerve cells of the brain, in the cerebellum, hippocampus major, medulla chlongata and cerebral cortex. They have never been demonstrated in the nerve trunks, but they have been seen in the nerve cells of both the plexiform ganglion and the ganglion closely associated with it—the sympathetic ganglion. Attempts to demonstrate Negri bodies in the saliva or salivary glands or the milk or the mammary glands, lachrymal secretion or lachrymal gland, and pancreatic secretion or pancreas, has never been successful, nor have Negri bodies been found in the blood or any of the tissues of the body excepting those named of the nervous system. It will be extremely difficult to satisfactorily explain, when Negri bodies are accepted as protozoa and the cause of rabies, why it is that these bodies cannot be demonstrated in the saliva or salivary glands or other body secretions or glands which are known to contain the virus, but some light may be thrown upon this puzzling fact when it is remembered that the life cycle of many of the known rhizapods or sporozoa is extremely complicated and spore forms or sporozoits exceedingly small are formed some which may be of the size, out of the zone of vision. It is therefore reasonable to conclude that similar small sporozoit formation may be a part of the life cycle of the Negri body protozoon, and that it is the small sporozoits in the saliva and other secretions which have as yet not been demonstrated. Negri bodies were first demonstrated in sections of the brain tissue and many different stains are in use. They are readily demonstrated in sections stained with haematoxylin and ecsin, but there are other stains which may be used to advantage to bring out the inner structure more clearly. In 1904 it was suggested to Williams[10] that it might be possible to demonstrate Negri bodies in smears of the brain tissue, which was tried and found to be a highly satisfactory and quick method to demonstrate the bodies. The smears are made by spreading over a slide, a small piece of brain tissue in which the Negri bodies are most frequently found. The tissue is placed upon a slide near one end and is covered with a cover slip. Pressure is then applied upon the cover slip and the brain tissue flattened out and spread toward the other end of the slide. The smears before they are given an opportunity to dry are placed in absolute methyl alcohol, one to three minutes, which, in hehydrating the tissue, firmly fixes the smear upon the slide. The methods of staining these smears are numerous and most all of them good, providing they bring out the inner bodies and stain the structure surrounding these inner bodies of a different shade or color, than the nerve cell in which they are found. In the laboratory of the Pennsylvania State Livestock Sanitary Board, the following procedure in the demonstration of the Negri bodies has been closely adhered to during the past four years: As soon as the animal's head arrives at the laboratory, the entire brain and the plexiform ganglion, with its closely associated sympathetic ganglion, are removed (see Plates I and II). A portion of the cerebellum is placed in sterile glycerin, in which the brain tissue may be preserved and retain the virus for many weeks. These glycerin immersed specimens are only referred to when the microscopic examination is unsatisfactory for the animal inoculation test. Aside from preventing de-

composition, the glycerin will also destroy bacteria and check decomposition of the specimen. From the fresh brain tissue, smears are usually made from the hippocampus major and cerebellum (see Plate II). A piece 1mm. thick and several mm. in diameter cut from the fresh surface exposed, after an incision is made through the hippocampus major at right angles to its length, or of the cerebellum in which an incision has been made at right angles to the convolusions, is placed upon a slide near one end. Instead of using a cover slip, another slide is placed over the small piece of tissue and gentle pressure is applied and the opposite ends of the slides are moved toward one another. The smears are then placed in absolute alcohol for two to five minutes, whereupon the alcohol is allowed to evaporate and the smears then stained. The stain as recommended by Van Gehuchten is used.*

Loefflers alkalin methylene blue, ...	one part.
Distilled water, ...	one part.

Saturated alcoholic solution of fuchain added in drops until the mixture has a purple tinge, or until a metallic scum is seen on the surface.

The mixture kept at a low temperature can be used for an unlimited length of time but is apt to change quickly at room temperature, and for this reason a new batch of stain is usually made each day, or as each specimen is prepared for examination. A smear properly fixed upon a slide is taken up with a pair of forceps and completely covered with stain. The slide is passed through the flame of a Bunsen burner several times until steam arises from the heated stain which is permitted to remain upon the smear for five to thirty seconds. The smear is then washed in running water, and if the color of the smear is blue where the brain tissue is most thick, and red where the smear is thin, the slide is placed between filter paper and dried. As soon as the slide is dry a search is made for large nerve cells with a low power lens under the miscroscope. The protoplasm of the nerve cells should be stained a light blue, the nucleus a shade of purple and the nucleolus a dark blue. If the cells are stained too deeply the stain may be weakened by the addition of more distilled water or in heating the staining fluid on a smear for a longer time, the intensity of the staining of the fuchsin will be increased at the expense of the blue of the Loefflers alkalin methylene blue. When a nerve cell is found properly stained it is examined with an oil immersion lens. Negri bodies with this staining fluid show the inner bodies a bluish black, and the structures around the inner bodies a maroon red. They are found within the cell, outside of the nucleus of the cytoplam in the nerve cells of sections, but not infrequently in smear preparations, a few Negri bodies not within the nerve cells are seen which have been forced out of the nerve cell as the smear is made. In searching a smear for Negri bodies, only those bodies within the nerve cells should be considered.

Frothingham[11] in 1906 demonstrated his impression preparations which he uses in preference to smears. Impressions of the tissue

*Dr. John H. Engel, first assistant in the laboratory, who has been entrusted with the examination of the smears during the past two years finds the following formula of the above mixture as a satisfactory stain for the average specimen:

Loefflers alkalin methylene blue, ...	5 c. c.
Distilled water, ...	20 c. c.

Saturated alcoholic solution of fuchsin 4 drops.

under examination are made by pressing a slide over a fresh cut surface, usually of the hippocampus major or cerebellum. The section of the tissue, hippocampus major or cerebellum, is flattened out with a slide under pressure. The slide raised from the tissue will show a film on the slide which was in contact with the tissue, and this film may be fixed and stained as smears. In the film, the outline of the nerve cells and cellular structure taken up, is little disturbed. In the impressions, the Negri bodies are not so apt to be misplaced or rubbed out of the nerve cell as they are in the smear preparations. The stain for Negri bodies used by Harris[12] has been tried and found to take up more time in its application than the Van Gieson stain, but at the same time the inner structure and the differential stain are well brought out and the stain is recommended in the examination of specimens in which the Negri bodies are very small in size, or inexceedingly small numbers. With good material, Negri bodies may easily be demonstrated by either smear or impresions in several minutes. Fresh material is considered better than decomposed, but in our experience Negri bodies are more easily demonstrated in brain tissue from an animal dead 24 to 48 hours, than in tissue examined within a short time after death. The changes that take place in the 24-48 hours after death appear to prepare the tissue so that Negri bodies stand out more clearly, and smears and impressions show clearer nerve cells. Decomposition does not interefere very much in the examination until the outline of the nerve cells is destroyed. Even when nerve cells are no longer seen Negri bodies may be found, but it is not safe to venture a diagnosis on these extracellular bodies alone. Although it is believed that Negri bodies can be demonstrated in from 97 to 99 per cent. of animals afflicted with rabies that have been permitted to die a natural death, the results of the examination of the hippocampus major and cerebellum, by means of smear preparations, as shown in the following figures do not show this to be so:

	393 Positive Cases.	146 Negative Cases.
Hippocampus major 539,	349 (86.3%)+	143 (97.9%)—
(Smears for Negri bodies),	37 (9.6%)—	0 (0.0%)+
	7 (1.7%) S	3 (2.0%) S
	341 Positive Cases.	**145 Negative Cases.**
Cerebellum,	301 (88.2%)+	141 (97.5%)—
(Smears for Negri bodies),	33 (9.6%)—	0 (0.0%)+
	7 (2.0%) S	4 (2.7%) S

+Positive. —Negative. S-Suspicious.

The high percentage 9.6 per cent. of failures to demonstrate Negri bodies in positive cases is unusual, and perhaps partially explained in that many of the specimens examined were from animals killed early in the onset of symptoms of the disease, and in that the specimens examined have been in all stages of decomposition. Our

greatest difficulty in demonstrating Negri bodies in the smears is experienced with the specimens from the larger animals, particularly the horse. The brain of the horse seemingly contains a substance which interferes with the proper staining of the smears or impressions. Then too, the distribution of the bodies in the brain of the horse is not uniform; they are apt to be localized and this fact also accounts for the percentage of failure to demonstrate Negri bodies. The same difficulty in the staining of smears or sections and the tendency for the bodies to localize is met with in the hog and deer, to a less extent in man, and only occasionally in cattle.

In 127 instances in which animal inoculation tests were made following the examination of the brain tissue for Negri bodies, in not one of the 61 in which Negri bodies were demonstrated in the material inoculated did the rabbits fail to develop rabies. In 66 in which Negri bodies were found in the material inoculated, the animal inoculation test was negative in 52; in 14 the animal inoculation tests proved that rabies existed. Negri bodies during 1906 and 1909 inclusive have been sought for in 728 cases and found in 512, and in 216 no Negri bodies were found.

RULES REGULATING THE EXAMINATION AND DIAGNOSIS

Negri bodies and the Van Gehuchten-Nelis changes make their appearance in the nervous system a short time before the animal shows symptoms. The virus, however, may be present in the saliva and the animal capable of transmitting the disease several days before symptoms are observed. From the routine examination of specimens, it is seen that Negri bodies are most abundant and the Van Gehuchten-Nelis changes most marked in dogs that have died a natural death. In those animals destroyed early in the course of the disease, it is difficult and at times impossible to demonstrate Negri bodies or Van Gehuchten-Nelis changes, although rabies exists. Therefore, the rules regulating the examination and diagnosis depend upon the manner in which the animal met its death. It is always desirable to have this information with the specimen.

Specimens from animals that have died a natural death, those not destroyed, are examined and the diagnosis is made as follows:

1. Smears are made and examined for Negri bodies, and as soon as the bodies are found the examination is discontinued and a diagnosis of rabies is made.
2. When Negri bodies are not found in the smears, sections of those structures already examined by the smear method are examined, and if Negri bodies are found the examination is discontinued and a diagnosis of rabies is made.
3. When Negri bodies are not demonstrated, the plexiform ganglion are examined for the Van Gehuchten-Nelis changes, and if absent a negative diagnosis is made.
4. Where Negri bodies are not demonstrated and well marked characteristic Van Gehuchten changes are found, a diagnosis of rabies is made and the animal inoculation test is carried out to verify the diagnosis.

5. Where Negri bodies are not demonstrated and slight proliferation changes are seen in the plexiform ganglion, it is reported that the microscopic examination is negagtive, and that the diagnosis must rest upon the result of the animal inoculation test.

With those specimens from animals destroyed shortly after the first symptoms are noted and suspected of having rabies, the examination and diagnosis is made as follows:

1. Smears are made and examined for Negri bodies, and as soon as the bodies are found, the examination is discontinued and a diagnosis of rabies is made.

2. When Negri bodies are not found in the smears, sections of those structures are examined by the smear method, and if Negri bodies are found, the examination is discontinued and a diagnosis of rabies is made.

3. In those cases where the brain tissue is entirely destroyed and only the ganglia are obtained, the presence of well marked characteristic Van Gehuchten-Nelis changes in the plexiform ganglion is considered sufficient to base a diagnosis of rabies upon.

4. Where Negrgi bodies are not demonstrated and well marked Van Gehuchten-Nelis changes are found, a diagnosis of rabies is made and the animal inoculation test is carried out to verify the diagnosis.

5. Where Negri bodies are not demonstrated and no proliferation changes are seen in the plexiform ganglion, it is reported that the microscopic examination is negative and that the diagnosis must rest upon the result of the animal inoculation test.

As soon as the result of the animal inoculation test is obtained, it is reported. All experimental animals are kept for a period of 100 days, and if at the end of that time they show no symptoms, the animal inoculation test is considered negative.

In the routine examination of the specimens suspected of rabies in the laboratory of the Pennsylvania State Livestock Sanitary Board during 1905-1906 inclusive, 914 were included, as shown in Table No. II, the animal inoculation test was resorted to in 198 cases, 87 of which proved positive and 111 negative.

Specimens from a fairly large variety of animals have been examined and attention is called to the fact that Negri bodies were demonstrated in each of the species, including three human beings. The rabbits and guinea pigs tabulated are some of the experimental animals in which it was necessary to examine the brain tissue for Negri bodies. The brains of all the rabbits and guinea pigs that died within the usual period of incubation, were examined and the diagnosis was made on the Negri body in each instance. 73.9 per cent. of all the specimens examined were found positive, 22.9 per cent. remained suspicious and 2.9 per cent were too far decomposed for examination. The percentage of positive cases may be somewhat higher than is the experience of other laboratories, which must be attributed to purely local conditions.

In Pennsylvania, the State Livestock Sanitary Board prefers the confirmation by a laboratory examination of all epizootics as they arise in a new locality and not infrequently a rapid success of positive cases, make their appearance in the laboratory.

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In conclusion, I desire to draw your attention to the importance of establishing a milk hygiene service and would suggest that the State be divided into territories of such a size that each territory could be thoroughly covered by one agent, who would be capable of giving the farmer and dairyman practical knowledge on the production of milk under sanitary conditions.

I beg to acknowledge the ready assistance given me by Dr. T. E. Munce, Deputy State Veterinarian, who has had charge of much of the office work throughout the year. The clerical work has increased over the year 1909 and has necessitated employing additional help. Each day we receive many letters asking for information upon subjects pertaining to veterinary sanitary science, and by promptly answering such letters much assistance can be rendered to livestock owners.

Respectfully Submitted,

S. H. GILLILAND,

State Veterinarian.

REPORT OF FERTILIZER CONTROL WORK

Harrisurg, Pa., *December 31, 1910.*

Hon. N. B. Critchfield, *Secretary of Agriculture.*

Dear Sir:—In reviewing the work of the Fertilizer Control, I beg to inform you that during the year 1910, fifty-three counties of the State were visited by fourteen commissioned sampling agents, and two thousand eight hundred and eighty-seven samples of commercial fertilizer, and substances used for fertilizing purposes, were secured. One thousand one hundred and forty-four of these samples were subjected to separate analysis. The remainder of like samples were, in many instances, composited with the above samples, and the same brands sold in different sections of the State, were represented in the individual analysis.

This arrangement has enabled the Department to examine the same brand of fertilizer in different sections, without subjecting it to extra expense in re-examination of the brand.

The effect of this method of handling the work has not only provided for a larger scope under the limited appropriation made for this branch of work by the last session of the legislature, but has prevented unscrupulous manufacturers and dealers from offering and selling inferior fertilizers in sections of the State, when they knew that certain of their fertilizers had been sampled in some other section.

When deficiencies are noted in these composited samples, an individual examination is made of each sample entering into the composite, and the deficiency is traced to the particular fertilizer which is below guarantee.

Your special attention is directed to the fact that this extra service is performed by Dr. Frear and his corp of assistants without additional expense to the Department.

"For the purpose of indicating more specifically to the eye, cases deficient in guarantee, an asterisk has been affixed in the analytical tables where the ingredient has been found less in quantity than the manufacturer guaranteed. Too great emphasis should not be placed upon very slight deficiencies, because very slight imperfections in mixing and slight variations in analysis are practically unavoidable. The asterisk has been used, therefore, only in cases where the deficiencies amount to 0.2 per cent. or more, except where nitrogen has been guaranteed in amounts not higher than 1.0 per cent. in which case an asterisk has been affixed where the deficiency amounts to 0.1 per cent. or more."

Where the word "Bone" is present as a part of the brand name of any fertilizer, extra examinations are made to determine the source of the phosphoric acid contained in such fertilizer. There are reports on file in this office, showing that certain fertilizers in whole and in part, derive their phosphoric acid from other materials than pure animal bone as provided by the act of April 23, 1909. These cases, where the evidence is sufficient to warrant a conviction,

before the courts of this Commonwealth, will, in accordance with your instruction, be reported to you for prosecution.

The Department has terminated fifteen cases for the violation of the Act of May 1, 1909, and the Act of April 23, 1909.

The fines received from these prosecutions were $400.00 and turned over to the State Treasurer.

During the year just ending there were 1,482 brands of commercial fertilizers, and fertilizing substances, registered with the Department. The license fees amounting to $26,170.00, were received from this registration and turned over to the State Treasurer according to law.

The reported tonnage of fertilizers sold in this State, with its respective cost to consumers at points of delivery, is as follows:

Tons		Average selling price	Total
178,770	Complete fertilizer,	at $23 51	$4,202,882 70
70,596	Rock and potash,	at 16 77	1,183,894 92
19,876	Acid phosphate,	at 14 29	284,028 04
8,455	Bone,	at 30 09	254,410 95
1,042	Muriate potash,	at 46 49	48,442 58
293	Sulphate potash,	at 54 64	16,009 52
1,146	Nitrate soda,	at 52 58	60,256 68
995	Kainit,	at 13 92	13,850 40
14	Dried blood,	at 50 00	700 00
180	Tankage,	at 30 60	5,508 00
1,316	Basic slag,	at 20 66	27,188 56
46	Lime and potash,	at 8 50	391 00
282,729			$6,097,563 35

The cases of departure of goods from their guaranteed composition observed this year, includes only those cases in which it amounted to two-tenths per cent. or more, and has resulted in greatly reducing the percentage of brands found deficient as reported during previous years.

The unanimity existing between the computed valuations of the fertilizers sold during the year and the reported selling prices, has been such as to attract attention, and proved conclusively that the average manufacturer is endeavoring to give the consumers full value.

In conclusion, permit me to call your attention to an improvement that can be made in our present law "Regulating the manufacture and sale of Commercial Fertilizers," etc. While many manufacturers label their sacks in strict conformity with the Act, others attach much superfluous matter, such as equivalents of substances previously stated, which, in the end, are very confusing and in some instances misleading to the purchasers of the same. The improvement in the Act can be made by prohibiting the use of any statements, whatsoever, upon the package containing said fertilizer, other than those required by the Act.

Respectfully submitted,

H. E. KLUGH,

Clerk of the Fertilizer Control.

Dept. of Agriculture,
Harrisburg, Pa. Dec. 31, 1910.

REPORT OF THE BUREAU OF CHEMISTRY FOR THE YEAR 1910

By JAMES W. KELLOGG, Chief Chemist.

The amount of work done by the Bureau of Chemistry during the year 1910 was somewhat in excess of that performed during the previous year.

The collection of samples of Feeding Stuffs, Paris Green and Linseed Oil by Special Agents of the Department, in compliance with the provisions set forth in the laws regulating the sale of these commodities in Pennsylvania, was carried on as in former years. The number of samples of Feeding Stuffs secured was in excess of the number collected during 1909, while the number of samples of Paris Green and Linseed Oil received was about the same as last year.

The number of prosecutions for violations of these laws ordered during the year was 71, a slight increase over the number brought in 1909. The number of violations of the Feeding Stuff Law was 68, 8 of which were based on samples taken during the latter part of 1909. Two were brought for the adulteration of Linseed Oil and one was ordered against parties selling a mixture of chemicals for Paris Green. All but two of these cases have been adjusted satisfactorily to the Department. In the majority of cases, the defendants waived a hearing, plead guilty and paid the amount of the fines imposed by the magistrates, together with the costs in each case. Several hearings were held in different sections of the State, which were attended by the General Agent, Special Agents and the Chief Chemist, all of which were terminated in favor of the Department. The few cases referred to which were not adjusted are still pending, one being a Feeding Stuff case held over for a later term of Court, and the other being a Paris Green case which was reported to the District Attorney for prosecution in the district in which the sample was taken and which has not been called for a hearing. The fines and costs received in the settlement of cases of prosecution referred to, amounted to Two Thousand, seven hundred, fifty-nine dollars and forty cents ($2,759.40), and were covered into the State Treasury as provided by law.

During 1910, 1,420 samples of feeding stuffs were secured and forwarded to the Bureau by our Special Agent, who visited nearly every section of the Commonwealth. These samples were analyzed chemically and examined microscopically in our laboratory in the usual manner, and reports were made in each case to the Secretary of Agriculture, to the dealers from whom they were obtained and to the manufacturers or importers responsible for their production and importation.

The quality of the feeding stuffs examined was found to be considerably better than those secured last year. The number of deficiencies

was less, and the adulterants found were not of such a fraudulent nature as was discovered in previous years. This point may be illustrated by the fact that during 1910 no samples were found to be adulterated with peanut shucks and rice hulls, which adulterants were often found present before the Feeding Stuff Law, under which we are now working, became effective. A large decrease in the number of samples which contained weed seeds, was also noted.

The principal forms of violation which made prosecutions necessary, were due to false guaranteeing for the contents of protein, fat and fiber, to the presence of excessive amounts of oat hulls and cottonseed hulls, to the presence of weed seeds, to improper branding or labelling and for failing to correctly state the list of ingredients or to give the true composition of the Feeding Stuffs in question. As a result of a strict enforcement of the law, many brands of feeding stuffs of inferior quality have been excluded from being sold in Pennsylvania.

We have received from manufacturers and importers of feeding stuffs, 378 registrations for the sale of their products in Pennsylvania, representing over 1,200 brands. Many brands were alike in their composition, such as wheat by-products, distillery and brewery by-products and whole grain feeds. These registrations have been properly filed in the office. During the middle of December, in compliance with the requirements of the law, registration blanks and circular letters were sent to all manufacturers and importers of Feeding Stuffs, requesting the registration of the products which they were to place on sale in Pennsylvania during the year 1911.

Early in the year a bulletin was prepared, in which was given the results of the analysis and examination of the samples of Feeding Stuffs received during 1909, together with such information as was thought of special interest. Copies of these bulletins were sent to 6,500 manufacturers of and dealers in feeding stuffs, whose products were sold in our State. Copies of laws were also sent to a large number of these parties.

In order that we might keep in touch and compare our work with other analysts engaged in the Feeding Stuff Control work and the manufacture of feeding stuffs, a few samples were from time to time sent to and received from several chemists, for comparative check analyses. The results obtained on such samples were very satisfactory and proved that our results agreed remarkably close with those of other analysts.

The number of special samples of feeding stuffs received for analysis was 215. These samples were sent in from manufacturers and dealers in Pennsylvania, together with a fee of one dollar per sample, as provided for by law. The results obtained were promptly reported in each case and the moneys received were transmitted to the State Treasury. In many cases directions were sent with these reports in regard to the printing of proper labels, setting forth the guarantees and other information required by law, to be printed upon the sacks containing feeding stuffs or upon attached cards.

In answer to inquiries for information concerning the character of certain products received from citizens of the State, and from the office of the Secretary of Agriculture, about 50 samples were analyzed or examined and reports made in each case.

The exhibit of a large number of samples of Feeding Stuffs, together with the common by-products and some adulterants used in the manufacture of the same, which had been previously prepared, was shown at the meeting of the State Board of Agriculture during its January session. This exhibit proved to be of great interest to the members present, and an attendant was kept busy during the entire session answering questions in regard to our work. The names of many of those who were not familiar with the work done by the Bureau were taken, and copies of bulletins and reports were forwarded to them.

Twenty-five samples of milk, butter, etc. were examined for the Dairy and Food Bureau.

In the enforcement of the Paris Green Law, 417 samples were secured in different sections of the State by our Special Agent and forwarded for analysis. Upon the completion of the analyses, reports were made on each sample, to the Secretary of Agriculture, to the manufacturer or importer and to the dealer from whom the sample was obtained. After going over the reports from time to time, as they were received, it was found necessary in only one case to order prosecution. The sample received on which this prosecution was based, instead of being Paris Green and containing arsenic and copper, was found to be composed of a mixture of different chemicals with a green coloring matter, and to contain no arsenic or copper whatever. In practically all the samples received, with the one exception as noted, it was found that they contained the required amount of arsenious oxide in combination with copper and not an excessive amount of water-soluble arsenious oxide. Many samples were found which were not properly labeled or tagged, but, upon reporting these violations to the manufacturers or dealers in each case, a ready willingness was shown to comply with the requirements of the Paris Green Law, and statements were made that in the future all such goods would be properly labeled and branded. During the early part of the year a Paris Green bulletin was prepared, in which was given the analytical results obtained, together with a few pages of introductory matter and other information necessary to explain the results reported. Copies of these bulletins were sent to over 500 parties representing dealers and manufacturers handling Paris Green in Pennsylvania.

In connection with the Linseed Oil work, our Agent purchased throughout the State, 125 samples of Linseed Oil from dealers and forwarded the same to this Bureau for analysis. The analyses of these samples have not all been completed, but after considering the reports already made on the same, two prosecutions were ordered for the sale of adulterated oil. Our findings in these cases were corroborated by other analysts who were interested in the matter, and the parties against whom prosecution was ordered waived a hearing and paid the fine in each case. A few samples which have been partially analyzed and on which reports have not been made, indicate that some of these have been adulterated, and it may be necessary to order further prosecution against parties selling these goods. Owing to the high price of Linseed Oil during the year, many samples were found to be of inferior quality, and it is hoped that during the coming year, we may be able to secure samples of

such oil, in an effort to arrest adulterations of this nature. The principal adulterant used in such inferior grades of oil was found to be mineral oil ranging in amounts from 5 per cent. to 20 per cent. As soon as possible a bulletin will be prepared, giving results of analysis of Linseed Oil, together with information pertaining to the same, which will be forwarded to those interested in this line of work.

The office work of the Bureau has been very considerable during the year, and it was found necessary to employ the services of an extra stenographer for a period of ten weeks, to assist in keeping the large amount of work on hand up to date. Our correspondence has continued to be large and the answering of a large number of inquiries, the preparation of bulletins and reports, the keeping of records of analyses, court cases, accounts, registrations and the addressing of bulletins, etc., required much of the work to be done in haste, and consequently, not done quite as well as it should have been.

We can use the services of an extra stenographer to advantage, and it is hoped that in the near future, one may be employed. Owing to the fact that our appropriations were reduced during the last Session of the Legislature, we were prevented from employing extra help, which was at times needed, in order that our work might be more effective. It is earnestly hoped that larger appropriations may be made by the Legislature at their next Session, in order to make it possible for us to properly and more effectively carry out the provisions of the laws of Pennsylvania, under which we are working.

The personnel of the Bureau has not changed during the year. A few improvements have been made by the purchase of new equipment which have been of value. A new nitrogen apparatus has been installed, embodying the principal improvements now in use in the Bureau of Chemistry at Washington and in other laboratories, which has proved of great advantage over the one formerly in use in our laboratory. A new and valuable Refractometer has been purchased for use in the analysis of Linseed Oil which is much more accurate and gives better results than the one formerly in use. This instrument has also been of great assistance to us in this line of work.

Our library has been increased by the addition of valuable books of reference, and filing cabinets and cases have been obtained which will materially assist us in our work and help us to be more useful to the citizens of Pennsylvania.

Many thanks are hereby extended to the Secretary of Agriculture for the kind advice and assistance given, and to our General Agent, Special Agents and all employes of the Bureau, whose work has been faithfully performed.

PAPERS READ AND ADDRESSES DELIVERED AT THE ANNUAL MEETING OF THE FARMERS NORMAL INSTITUTE, HELD AT BUTLER, PA., MAY 24-27 1910

ADDRESS OF WELCOME

By HON. JAMES M. GALBRAITH, *Butler, Pa.*

Mr. Chairman and Members of the Institute: I am very glad on behalf of our town and our county to welcome the Institute to Butler. We have been looking for your coming for some weeks; in fact, there have been two events scheduled for about this time in the month of May, both of which we have been looking forward to with a degree of pleasure and, I suppose, some of our people, with a degree of apprehension, not of this event but of the other. I speak of the coming of Halley's comet which has been scheduled at the same time as the meeting of this Institute. I don't know that any of our people in the apprehension of what may happen from that have made their wills, but I am sure none have because they thought this Institute would come. They knew this was a good class of people to come into our neighborhood and so have been looking forward with pleasure to make your welcome, as our Chairman has said, what it should be and give you a good time.

To illustrate how highly Butler people think of their own town, I will tell you a story: A man of our town had a dream a few years ago. A friend of his had died some weeks before and in his dream his friend returned and he met him face to face and was very much surprised, and he said to him: "Why, I thought you had died some weeks ago and were in Heaven." And so he was, his returned friend explained, "but I want to say to you there is no place like Butler." So you see that we esteem ourselves pretty highly, and we hope that before you go away you will have a feeling, probably not quite as high as that of Butler, but with a good opinion of our town. We are very glad to welcome you here to-day because of what you represent. You represent the oldest calling that man has ever entered into. We read in Sacred Writ that away back in the beginning, when that beautiful Garden was framed and constructed for the habitation of man, that the Creator placed our first parents in charge of it to care for it. I am willing to admit that he possibly did not make a very good job of it in some respects, possibly because Adam was unfortunate in the choice of a wife,—but however that may be, no matter. He was placed in charge by the Creator who had made him, and that is a compliment not only to the man but to the occupation which was given to him, that of

Fig. 1. County Chairmen of Institutes.

caring for the beautiful garden in which he had been placed, pruning and keeping it and making it not only a source of advantage but also of pleasure as well. Now, from that day down to this I think I may say that the native occupation of the inhabitants of the soil, of the earth, has been the care of the earth and its produce, making it to bloom like the garden; making it to bring forth fruits and flowers and those things both healthful and beautiful. So that you represent all that was involved in that first occupation which God gave to the sons of men; the oldest occupation in point of time of any upon the face of the earth to which men have devoted their lives and energies.

And then we welcome you all because of the class of people you represent. You not only represent the oldest occupation, but you represent a class of people who are without superiors in any other class of people on the face of the earth. It is quite possible that I have a degree of prejudice in favor of the farming class, having been, as I have, fortunately brought up on the farm, I have always had a large degree of sympathy and interest in the farmers and their occupation, and for that reason I believe I am inclined to think that, taking them all in all, they are just a little bit better than any other class of people who follow any other occupation. They represent in large measure, I think, those solid virtues which are necessary in order for the welfare of any community or people. After all, it is upon those virtues largely found and largely preserved in the country homes of our land, it is to those we look for that substantial aid and help in every time of need which comes to every people and to every nation. We look to their substantial virtues and their strong common sense, to their patriotism, to their sense of what is right and depend upon people, most upon that class for the preservation of those things that are at the very foundation of our institution and our prosperity and of our future greatness as it shall grow. We depend more upon that class than any other class in our population.

And then we welcome you because of the greatness of the industry which you represent. I do not know, because I do not have the statistics before me to determine what the value of the products of the farms is in this nation of ours, but I think I can say, without fear of successful contradiction, at least that, the value of the products of our farms in this country far outstrips the products of our mines or any other industry whatever it may be. I think I am right in that. And so, too, we welcome you here to-day as the representatives of that industry, an industry that lies at the foundation of all our other successes and greatness and prosperity too. You are great, your occupation is great not only because of the magnitude of this industry and the magnitude of the value of the annual products of a great industry, but because of our dependence upon it. The kingdom itself is nourished by the production of the field and whatever istrue of the kingdom is true of everyone from the highest to the simplest citizen of the land. After all, we must come back to the land. The important question is always presenting itself, what shall we eat and what shall we be clothed with, and in answer to this important puestion we go back to the soil and its products because it is only with these that man can be fed and clothed and shall we eat and what shall we be clothed with, and in answer to

this importunate question we go back to the soil and its products that all men are dependent upon it.

Now, you have met here during these coming days to discuss these matters which are nearly related to the questions of the farming industry and all those other subjects that are related to the industry of farming, and they are many. I think we are coming to see more and more that the occupation of the farmer is not so much a matter of routine as once taken to be. We are coming to see more and more that it must be treated in a scientific way, and we are beginning to see that it is not an occupation in which any one man, be he ever so much of an enthusiast, can engage with success; but to farm successfully he must have a more scientific knowledge of those things which enter into it and to the means of securing the best production from the soil, and so you are here this week to discuss those questions in a practical way, in a way that brings them within the reach and understanding of the everyday farmers in this and other communities. There have been persons who have discussed in a theoretical way some of our agricultural matters, questions that are interesting from a theoretical standpoint but yet not wholly practical. Possibly you have all read that story that illustrates that class of articles, of the man who read a very learned paper before some gathering. He had been reading about the dehorning of cattle and so he wrote a very learned article on the practicability of the dehorning of hydraulic rams and, of course, it made a great hit with the farmers in attendance; and this is about the measure of some of the articles that are written or deal with farming in a theoretical way, they are wholly impractical. You are here to-day to discuss these things as practical means, to deal with all these questions of the farming industry in a practical way that will bring them down and reduce them to the farmer's standpoint.

Now, gentlemen, for all these reasons we welcome you to our midst. We hope that you will find your stay here pleasant, so pleasant, that in your future years you will never forget it and our town. If I could do it, I would like to present to you on a silver platter the keys of our city that would unlock to you everything that is good. I don't mean by that that you will find this a wide open town, because we don't pride ourselves as the Mayor of San Francisco, who on the eve of a great pugilistic exhibition that is scheduled to take place there shortly, has sent a statement across this country that San Francisco is not a closed town. I don't mean we are going to open up things in this way. We have tried to keep this a God-fearing, moral community and we hope to do that in large degree, and when we say that we welcome you to our community and all good in it we wish to be understood in the proper sense as welcoming you to those things which are righteous and uplifting. Our Chairman has told you of our schools and industrial institutions, all of which, if you have the time, will invite and I think interest you in an examination into them and their workings. We have plenty of churches here. We are probably better equipped with schools than almost any little city of our size in the State. They are very modern and in the lead and our teachers are brilliant instructors, and so we might go over all our interests. We have some large industries here and in those things we think you

Fig. 2. Farmer's Institute Lecturers.

will find this an up-to-date community and one that will interest you and afford you pleasant memories during the years to come.

So I hope then, during these days and hours, you will find your time pleasant, and again in the name of our people of the town and of the people of the county I desire to bid you a welcome, a hearty welcome to our town and community.

RESPONSE TO ADDRESS OF WELCOME

By L. W. LIGHTY, *New Berlin, Pa.*

Mr. Chairman, Hon. Judge Galbraith, Ladies and Gentlemen: In behalf of the Department of Farmers' Institutes, I would sincerely thank you for the kindly greeting and pleasant words of welcome so eloquently spoken.

The talk we just listened to was an inspiration as well as a welcome. We realize that we are in a great county. On my first visit to Butler I was shown your fine large school buildings and grounds and I was sure I was among a progressive people. When I went out through your county I found people of a high order of intelligence. Our institutes were well attended by the local people and the part they took was instructive and elevating. We also realize that we are in a county of wonderful resources and wealth, where the wealth of the earth extends deeper than mere plow depth. Out of the bowels of the earth you take that which gives us heat, light and energy. Wonderful wealth was or is stored down among the deep rocks, but once you discover its exact location you seem to pounce upon it like a pack of wolves on its prey. When I visited you a few years ago I found a town with derricks so thick that the rising and setting sun was hidden and I imagined they afforded an effectual windbreak for the country beyond. This shows enterprise; but a few months or years and that stored material will be removed and that will end that chapter. True, other "finds" are located and more chapters are added, but sooner or later you come to the end of that story.

But your real wealth—that which gave you an opportunity yesterday, is the encouragement of to-day and the hope for to-morrow, is in the few surface feet of the soil of Butler county.

Conditions were such in this country that for some years the farmer and his work was practically forgotten. We acted and enacted as though the foundation of wealth and welfare rested on manufacturing, transportation and merchantdizing and our people are just now learning that the manufacturer only changes the shape of things, the transportation people only change the place of things and the merchant only distributes things but that the farmer is the creator of things that did not exist before.

As the consuming population increased and the producing population decreased comparatively and the available soil fertility or

productive power of the soil was lessened, something confronted the people at large that was not a theory but an emphatic condition. If I read history aright, that is to say, if I read correctly between the lines, because the history of agriculture was never written, every civilization that this world ever saw grew and prospered as long as agriculture prospered, but as soon as the soil and the tiller thereof was neglected or robbed so as to cripple or demoralize his work, material was manufactured for the historian to write the decline and fall of that civilization. I find this true of Egypt, Asia Minor, Greece and Rome. The trend in this country was heading for the same goal; but several factors altered conditions and we are now trying to relocate on a new basis. Unlike in the older civilizations, not the state, but the individual owns the land in this country and when conditions became unfavorable he could let the soil and its fertility "go to the dogs" to use a familiar expression, and that is what he did in many cases.

WHAT HAS HAPPENED

Thousands of square miles of former farming land have been abandoned and many more thousands of square miles have been abused and neglected until they produce only the fifth or tenth of what they did some years ago. Five or ten years ago it was about impossible to sell a farm. An active intelligent boy would hardly think of farming, and all roads lead to town and were traveled in but one direction. If the gold output is great or small, the tariff high or low, the trusts "busted" or not when the consumers increased rapidly and the producers and their produce decreased rapidly the inevitable arrived, and if you would learn the manner of its reception just read the dailies, weeklies and monthlies as they are dumped before you by the wagon load. A few wise men forsaw all this trouble and tried to avert it by

Organizing the farmers.

Instructing the farmers.

Providing better educational facilities for farmers children.

Affording by mail delivery, parcels post and otherwise good facilities of communication and transportation.

In all these efforts, the Farmers' Institute movement took the initiative and the lead, except in organization, that being the mother of all rural agitation and education. I will not become reminiscent, though tempted: In our own State this work was started by a good Chester county farmer, followed by a Centre county farmer, and during the last ten years the work was in the hands of a Lawrence county farmer, who threw his whole soul and energy into the work and developed an institute system second to none in this United States. This institute movement set into motion forces that were not dreamed of several years ago. It not only compelled farmers to think but all other classes of intelligent people.

Who dreamed that the railroad people would spend time and money to help the farmer develop his business? Every big railroad system now appropriates a fund for this purpose. To-day our Normal School authorities are in a ferment about the question of pre-

paring teachers to teach Agriculture in the public schools. Men who are capable along these lines can not nearly fill the present demand. Farmers are called in to assist. Several days ago I was asked to speak to the students of an eastern Normal School, and a more eager and attentive audience I never had. In speaking before a preparatory school, I was surprised at the interest manifested by the boys in the agricultural college and the prospects for the graduates from an agricultural course.

My friends, our work sets the world to thinking seriously about the farmer. It is compelling conditions that will give the farmer a square deal. I am exceedingly proud to be associated with a body of men who have already accomplished great things for the present and future welfare of this great Republic. Let no one imagine that all this came about as in the natural course of events without any one giving the matter much consideration, because such would be a gross mistake. Practically every one connected with this work did a lot of honest, hard and faithful labor. The Director of Institutes, like the general of any army, found that eternal vigilance was the price of success, ever alert, straining every nerve to conquer ignorance and prejudice. With the majority of lecturers, I have been associated with for years and know them to be sterling and conscientious workers for the good of the cause.

But I wish particularly to speak a word about the County Chairmen, who have charge of local matters in the county and without whose aid the work would be one-sided, or unbalanced at best, and possibly a failure in many instances. Two weeks hence these county chairmen will meet with their people and arrange places to hold the next meetings. Later, the places will be visited, committees appointed, programs arranged and the folks interested to make the meeting a success. Days, yes weeks are spent by them in advertising and perfecting arrangements at the different places. When the time comes to hold the meetings, these men come out to the railroad station to meet the lecturers and for the next week or two stay with them looking after their welfare and comfort to the best of their ability—very often themselves suffering discomfort and exposure so the men with them may be well cared for. These men go out and brave the storms and blizzards, drenching rain and driving sleet over roads that baffle description, as well as the traveler. And what compensation tempts these men to do all this and much that I have not enumerated?

No compensation, my friends. Love for their fellow-men, love for country, patriotism and loyalty to duty of the highest citizenship prompts them to do this. Personally, I associated with about a hundred of these men and I honor and respect them as I do the veterans who defended our country on the battle field, indeed a number of the older ones wear the Grand Army button. A noble, self-sacrificing, conscientious body of men who deserve many-fold the thanks and credit they get from the people whom they serve without renumeration or the thought of pay, only the results of their work in the betterment of humanity. Such is the body of men and women you welcomed and I hope their visit and deliberations for a few days in your city with your excellent people may prove mutually beneficial. Again I thank you for your kindness and many courtesies.

RESPONSE TO ADDRESS OF WELCOME

By R. P. KESTER, *Grampian, Pa.*

Mr. Chairman, Ladies and Gentlemen: In behalf of the visitors who have come to your beautiful city to spend a few days, we thank you for the words of welcome so aptly spoken. While we recognize this part of the program as something formal and perfunctory, yet we have already seen enough and heard enough to convince us that your words are sincere and we shall take your words of welcome at their face value. Surely you must be a hospitable people to invite two bodies of agricultural people to your city in one year. We appreciate this because it shows you to be a people alive to the importance of agriculture.

Representing, as we do, the several counties of this great Commonwealth, we will, if we can, impress you still more with the importance of this great industry in the Keystone State; a State far-famed for its wealth in minerals and the products of its countless factories, but which we are prone to forget holds a place in the front ranks of agriculture as well. We have, perhaps, been too busy or too modest to advertise ourselves as others have done for themselves, or perhaps we do not fully realize that no other industry in the State produces so much wealth or employs so many people.

While we are pronouncing these mildly boastful words, we want to acknowledge to you that we have not so nearly reached perfection in our art as have those in many of the other great industries of the State. Because, first, there is more to learn; and second, because we have not had the chance in the past to learn the fundamentals of our business. Yet, in saying this, we would have you know that we feel ourselves to be as intelligent in this respect as those in states more purely agricultural. It has been said by those who know that the Farmers' Institutes in this State, of which this is an epitome, are equal to any held in the Union. That our Department of Agriculture, our State Board, our Granges and other farmers' organizations are laboring as earnestly and effectually as those of any other states.

There are three things that those who have the best interest of agriculture at heart are laboring for: Better rural schools and a school curriculum suited to the needs of rural people; a better understanding of the principles and possibilities of agriculture so that it may become more renumerative and hence more attractive to the young men and women; and third that agriculture receive at the hands of our law-makers a just and proper consideration. That they recognize the fact that the "Infant Industries" have become overbearing towards the parent. You who are city born and bred may query why this work of education should be done at public expense. You will recognize the justice of it when you remember that agriculture lies at the foundation of all other business. That when panic seizes and throttles all other business, agriculture is the giant hand that saves.

In thanking you for this kind greeting, we beg you to keep temptation away from us. Keep your confidence and gold-brick men restrained. Put us to sleep where there is no gas to blow out. Stop your street cars at night and have breakfast at 5.30 in the morning. These requests we make freely because you have greeted us so kindly. In turn, we promise to overlook your short-comings when you visit us in strawberry and spring-chicken time.

THE FARMER A MANUFACTURER

By PROF. FRANKLIN MENGES, *York, Pa.*

I might as well begin this discussion by stating what I do not mean by making the farmer a manufacturer. I do not mean that he shall go back to the early conditions in which his grandfather lived. I do not mean that he shall use for lighting his house the ancient tallow dip instead of the kerosene, the gasolene, denatured alcohol, acetylene or electric light burners of the present day. I do not mean that he shall warm his house and cook his meals in the log filled fire place of the ancients, instead of with the modern hot air, hot water or steam heating apparatus and the gasolene, denatured alcohol, and gas ranges of to-day. I do not mean that he shall give up his high pressure water system furnishing him water for his entire plant as well as better fire protection than most of the small towns have, and go back to the old oaken bucket. I do not mean that he shall change his factory-made clothing of the most delicate weaves and the latest cut to the homespun and misfits of his not distant ancestor. I do not want him to return to and depend entirely upon the home grown viands of his grandmother, but I would rather his table be graced with the delicacies of both hemispheres. In short, I mean that the farmer's manufacturing plant shall be equipped with all the labor-saving machinery of the day. I recognize the fact that by introducing the farmer into the industrial system, or rather into the manufacturing world where labor is applied with the greatest economy, which necessitates the division of labor, and also the introduction of varied and delicate machinery, requiring trained mechanics to handle, and which economy leads to new discoveries and consequent invention of still more intricate machinery and a demand for large capital to conduct these ever enlarging enterprises; I say I recognize that I am enlarging his sphere immensely and introducing him into a domain for which he has little adaptation, moreover I do not mean to do away with our present industrial system and hand all over to the farmer and make him the all and in all to all the world, but I mean in these vast activities in which up to this time he has only been the producer of the necessities of life and in many instances only the raw material which he has handed over to a middle man to sell for him and the middleman has sold to the manufacturer and in many instances the manufacturer used another middleman to dispose of

the manufactured goods until the whole system has so permeated our national life that we have a business government, so intricate and vast in all its ramifications that it sets our little brains whizzing and buzzing and we give up in despair and go back to production again.

I want the farmer to do some of this manufacturing, especially that pertaining to his products, both for his own benefit and for the benefit of the consumer, because, this handing over the sale and manufacturing of the farmer's produce to a middleman and manufacturer has for some, to me, inexplicable reason centered all manufacturing in cities and towns and has deprived the farmer of labor and large quantities of waste material. This deprivation of the farmer of his labor and the enormous demands of profit by so called business and manufacture, enabling both to pay larger wages than the farmer, has made the farmer the servant of the entire system, and may finally result in a reduction of consumption of the farmer's products, as has already been done by an anti-meat consuming organization started in our national capital, and thus deprive the laboring man's dinner pail eventually of the viands that grace the middleman's and the manufacturer's tables, and in this way this system puts the farmer, the producer, and the consumer at the mercy of the middleman and the manufacturer. It vitiates the farmer's efficiency, and makes him a derelict of his God-given duty, that of feeding mankind, and mankind at the present time lives largely on manufactured food.

Take the crops he raises on his farm and, with few exceptions, they have to be manufactured before man now uses them as food. The farmer does little or none of this but sells to a second party who may ship it to the manufacturer, who manufactures it, ships it to the consumer or perhaps to the very farmer who produced the article, with the added cost of two, three or four handlings and the commissions of as many intermediaries, costing probably more than it cost to produce the original article. The staple crops, such as wheat and corn, except in its unripe condition, must be manufactured before they are in condition for consumption by man. From one-half to two-thirds of the corn crop and from fifty to sixty per cent. of the wheat crop is inedible by man. The same thing is well nigh entirely true of the grasses and clovers from which he makes his hay, and in order to make these available for human food he must utilize the animal, especially the ruminant, the digestive machinery of which is so constructed that it can digest the cruder celluloses and convert them into human foods through a vital machinery of the highest efficiency. I said a machinery of the highest efficiency. He will therefore use a cow that will convert approximately the same amount of food into 9,000 pounds of milk instead of a cow that will make only 3,000 pounds of available human food out of these inedible, by man, products of the soil.

Here is the beginning of his manufacturing operation. He does all the risky, expensive, laborious and delicate work in the process of production, and why should he not do the manufacturing that is necessary and wherever it is possible to do this, instead of handing it over to be manufactured by one man, peddled by another and consumed by a third and let each one of these intermediaries have as large or even a larger profit out of the operation than he has and then call that the business end of the transaction.

In order to show that what I am saying is practical, I have made a little investigation in the city of York. I have collected some statistics from a number of our cattle dealers. Lewis Ahrens & Co., one of the largest dealers in the city, gave me the following figures from the record of their transactions during the year 1909: They sold for slaughtering to the butchers of York during that year 2,764 cattle, 1,625 hogs, gathered largely from York county and Maryland, and 417 shipped in from the West, making a total of 2,042 hogs sold by one dealer. W. A. Little & Co., another firm, gave me approximately the same number of steers and hogs sold to the butchers in York. Besides this, Mr. Ahrens sold over 2,700 steers as feeders to the farmers in York county, many of which were afterwards bought by York butchers and slaughtered there and at least some of the beef consumed in York, so that it is not by any means an exaggeration to say that from 4,000 to 5,000 steers and from 4,000 to 6,000 hogs are consumed every year in the city of York. Very few of these steers and only about half of the hogs are raised in York county.

FARMS FOR RAISING HOGS AND STEERS

There are easily two hundred 100-acre farms within six or seven miles around York. Enough of that crude cellulose inedible by man can be produced on every one of these farms to raise and prepare for market 300 hogs or 24 steers every year. But suppose we take only 20 of these 100-acre farms and we will say that each one of the 20 farmers raises and puts into marketable condition 300 hogs every year. But we do not want this farmer only to raise the hogs but to do the manufacturing also. He slaughters and prepares for market and markets them one a day every working day in the year and he sells that pork directly to the consumers. He can share profits with the consumer and at the same time undersell the men to whom he used to sell his products, men with their millions behind them. But let us take 100 of the remaining 180 farmers in the vicinity of York and have them raise and prepare 24 steers each for market and do the manufacturing and marketing of 2 steers a month or a total of 200 steers a month or approximately 6 steers a day for the consumers of the city of York. These men can compete with any combination however strong because they have eliminated the cost of long distance transportation both of steer and the manufactured product and the charges of intermediaries. They raise on their farms what is needed for feeding these steers, for they stop plowing down green crops when they are in the most digestible and efficient feeding condition for animals and feed them to their animals and stop buying concentrated feeds and paying enormous profits and transportation for these, and what is still more they use the excrement of these animals when in its highest efficiency as fertility and keep up the productiveness of their soil. I do not mean to say that he will not need to add some one or two perhaps of the ingredients of a fertilizer to some crops they raise, but this will be a minor consideration. They are working along the line of a permanent agriculture. The by-products of their manufacturing plant they convert into poultry, eggs, beef or pork.

OTHER MANUFACTURERS

Not only is this true of the manufacturer in the limited way I have here indicated in the local production of beef and pork, but all other food stuffs are so high already that they will not stand the added cost of transporting the raw material long distances to be manufactured into edible forms and then reshipped to the consumer in the immediate vicinity where they were grown and where they might have been manufactured as well or better for no more cost than at the distant center, without the cost of transportation. This the co-operative societies of the West have been recognizing and they have been working along the lines of manufacturing the raw materials of our food stuffs in the vicinities where they are grown. Certainly the natural conclusions is that sections should raise the crops for which their soil, climate, market and labor conditions are best adapted.

POWER

This naturally brings us to the question of power. The manufacturer must have cheap power to run his factory and if the farmer is to become a manufacturer he must have cheap power for it is he who *must reduce the high cost of living.* It is my firm conviction that one of the most paramount duties of the State and the Nation is to inaugurate a series of investigations and experiments with the end in view of conserving, developing and utilizing for power and where needed for irrigation, the energy that now flows down our rivers and streams undeveloped and unused. But there is another source of power which is grown and available on every farm in the land in the shape of indigestible cellulose, both by man and animals, that has not been used by the farmer. Fifty per cent. of corn stover and little if any of the cellulose of the corn cob can be digested by our animals and we know that tons and tons of these substances are produced on all our farms. We have now discovered that these can be converted into power by making them into alcohol.

INDUSTRIAL ALCOHOL FROM SAW DUST

At a meeting of the Canadian Section of the English Society of Chemical Industries, held at Montreal, Canada, October 22, 1909, Prof. R. F. Ruttan, M. D., read a paper on Ethyl Alcohol from Saw Dust and other Wood Waste, published in the Journal of the Society of Chemical Industries of England, December 31, 1909, pp. 1290-94, also in the Scientific Supplement, April 16, 1910, in which he shows that the Classen process for the manufacture of alcohol from the waste material of wood has been so modified and improved by two chemical engineers, Messrs. Malcolm F. Ewen and G. H. Tomlinson that it now has become a financial success. These gentlemen conducting their experiments at Chicago Heights, near the city of Chicago, with a plant erected by the Wood Waste Products Company, now the Standard Alcohol Company, under their direction and by the use of their patents. It is known that the raw material out of which denatured alcohol is made at the present time costs from 20 to 24 cents a gallon. These men have shown that from the wood waste of large saw mills and wood manufacturing

plants where saw dust and other waste is often a nuisance they can make from a ton of this waste from twenty to thirty gallons of alcohol at from two to two and one-half cents a gallon for raw material and a number of by-products such as turpentine, acetic acid and have sixty per cent. of the saw dust remaining.

In order to be certain that I was not misled, I wrote to the Standard Alcohol Company, 505 Rookery Building, Chicago, and asked them a number of questions to which I received the following reply:

"Standard Alcohol Company,
505 Rookery Building,
Chicago, Ill., May 10, 1910.

Dr. Franklin Menges, York, Pa.:

Dear Sir: Replying to yours of May 7th, the writer is not prepared to answer the chemical questions that you ask. Our chemist is at present at Georgetown, S. C., where we are erecting a large plant, but we are sending you to-day copy of the Scientific American Supplement, last issue, which contains a two page article by Dr. Ruttan, which may be of service to you.

In answer to your question as to why we do not get more than twenty gallons of alcohol per ton, would state that we have obtained thirty and thirty-two gallons, but as it is a commercial proposition we do not wish to overstate or over estimate the yield; so have accepted twenty gallons for the present at least as the basis of operation. When our plant is in full operation we will undoubtedly learn more about yields.

We have not tried any of the other cellulose material commercially, but have experimented in the laboratory with those you name, as well as peat and cotton, and see no reason why we should not get the same results as we get from the wood cellulose.

Nothing has been done anywhere in reference to promotion of the business excepting in the United States. Other countries will follow we expect, by this Summer, after we have our plant in Georgetown, S. C., in operation. We expect this will be started in a couple of weeks.

We have many inquiries from abroad from people who wish to become interested financially but have held them off pending the operation of our plant, so that they can see exactly what the operation is before they go into it. * * * * * *

Yours very truly,
STANDARD ALCOHOL COMPANY,
JOHN M. EWEN,
President."

Another source of power, and one in which the State of Pennsylvania has advantages over any State in the Union, is that from producer gas. This gas can be manufactured at the mouth of the coal mine, conducted from there in pipe lines to the consumer or converted into electric power and furnished in this shape for the use of the manufacturer. Any one desiring any further information about this source of power development will find a very interesting discussion in Bulletin No. 416, U. S. Geological Survey. It will be noticed that this power is made on the farm or nearby.

THE CO-OPERATIVE CREDIT COMPANIES

The question naturally arises, where shall the average farmer of to-day get the money to introduce all these new ideas and how will the young farmer of the future be able to begin operations when he will be obliged, in order to compete with his neighbor, to introduce one or the other of these manufacturing plants or become a partner in one to enjoy the privileges it confers, where will he get the money? These and similar questions, when land values increased in Germany, confronted the German farmer and had to be solved. This condition brought into existence "The German Co-operative Credit Companies." These companies are formed by a number of farmers who get together, take a careful inventory of the property of each and determine how much credit each is entitled to and then they assume joint responsibility for the amount. They get a charter and elect officers and they are ready to begin business. When the members of the organization wish to avail themselves of this credit to go into a joint enterprise they go to the cashier, make themselves responsible for the amount of credit each is entitled to, when the cashier issues them a note or bond which they offer for sale in the market. These long time notes or bonds, ranging from twenty to forty years, have proven so secure an investment that the demand is greater than the supply. The rate of interest is from three to four per cent. or rather it ranges very closely with the profits of the farming business. When a member of the company has money to spare he deposits it with the cashier and receives a certificate of deposit which entitles him to a rate of interest equal to that which he would be obliged to pay were he borrowing money, and in this way the company becomes a Savings and a Loan Association. When a member buys an addition to his farm, his credit is expanded to a prescribed proportion of the value of the land bought, and if he demands it the credit of the company is given him in the form of a bond which he is allowed to sell. This credit is usually on a forty-year term. A small annual payment, sufficient to pay the debt in forty years, accompanying the interest, is demanded. Some of these Credit Companies are over a century old and have flourished throughout this interval of time, and have been the agencies through which seven-eighths of the agricultural land of Germany has been retained by or acquired by the men who till it, a condition that does not exist in any country in the world so far as I can discover. If in Germany, where land values are high and taxes enormous, these companies can do such service what would not be the possibility of such an organization in America? It will raise the farmer at once into the domain of business. He will at once see and feel the effects of legislation. Transportation in all its phases by ocean steamer, through internal waterways, by steam and electricity, and even through the air, will appeal to him and enlist his interest. Making the farmer a manufacturer will mitigate city congestion and at least some of the evils of congestion will disappear. It will bring the producer and consumer closer together and, as already indicated, it will reduce to the minimum the cost of transportation. But what is still of more value, the formation of a co-operative credit association will create a community of financial interests and it cannot help but make a closer social union of the farmers in such communities.

THE TRAINING OF THE FARMER

But the next question that is in the mind of everyone is, How shall the farmer get the training for the business transactions and the manufacturing involved in such a scheme? This is the crux of the situation and one that will have to be met and answered by our agricultural educators. First, by the lecturers at Farmers' Institutes because it is they, though I am sorry to say in a limited way, that bring the college to the average farmer. But this is only the merest beginning, and the next agents are the Departments of Agriculture of both State and Nation; but over and above all is the Experiment Station and the Agricultural College. Up to this time the Experiment Stations have confined their energies largely to the production of two blades of grass where one grew before, not that it was the desire to do this by those who were managing the work, but very often largely on account of the indifference of the farmer and the agricultural interests of the State to supply funds for the work, and where funds were available men could not be gotten to give the kind of instruction needed. We know that not by any means all the waste on the farm is in production, but that sometimes more waste occurs in the marketing and utilization of the products of the soil. The investigations at the Experiment Station should therefore include agricultural, manufacturing and the utilization on the farm of all waste products in the best way possible. This is an enormous field and a simple enumeration of all it involves is impossible. But the Agricultural College must also train the teachers to begin this kind of vocational instruction in our public schools. She must teach methods to increase production, methods to prevent the waste that is going on on the farm, methods of agricultural manufacturing, methods of utilizing the various kinds of power at the command of the farmer, methods for the best utilization of the various soils of a community, methods of producing and growing more efficient animals on the farm. She should have a Department of Economics which should be so directed that it would cover the field of transportation, manufacturing and market, etc., as these relate to the farmer and the workman of these various communities, a Department of Sociology, a Department of Agricultural Architecture, a Department of Agricultural Sanitation, but over and above all, a department for raising better men and women on the farm.

Let the Normal Institute resolve to begin a movement to so equip our Agricultural College and Experiment Station with facilities for instructing students in the elements of these various activities, whom she may send forth from her halls and fields to impart these elements of vocational training in our public schools so that the future farmer will be the master he should be instead of the servant he otherwise will be.

STARTING AN ORCHARD

By PROF. W. J. GREEN, *Wooster, Ohio.*

There are various operations involved in starting an orchard. One may know how to do all things needful and yet fail to grasp the full purpose and meaning of the work as a whole. A thorough knowledge of methods is needful, but in order to modify methods so as to adapt them to varying conditions there must be a clear conception of the reason why. Theory and practice are of equal importance, and one must supplement the other.

It is a truism to say, that the orchardist needs, first of all, to get a clear conception of what his purpose is in growing an orchard; but we may properly ask, "Why does a man plant an orchard and then devote the ground to grass or corn, or potatoes, or any other farm or garden crop?" One may answer that he wishes to utilize the land to the fullest extent. The trees need but a portion of the plant food, and all that can be taken from the soil beyond the small amount required by the trees is clear gain. Another may go still further and claim that the cultivation of the crop is just what the trees need. Both of these propositions may be true in certain cases, but altogether false under other conditions, hence the necessity of a well grounded theory to begin with.

There are various purposes to which a family orchard may be devoted, along with that of fruit production. The stock breeder needs a calf pasture, and if the orchard is conveniently located for that purpose he may make it do double duty. This custom is so common and so well established in most sections that it is regarded as a thrifty practice. There are various side issues for which an orchard may be used, but to describe them would be foreign to my purpose.

We need not quarrel with those who desire to start a dual purpose orchard; but let me hasten to say that a commercial orchard is for one purpose only, and that is for the production of fruit. Unless the crop of corn, potatoes, vegetables, small fruits, grass, or whatever is grown between the trees tends toward the accomplishment of the main purpose that crop has no business in the orchard. The orchard, how to grow it, so that it will give maximum crops of fruit, is the motto, not how to produce bumper crops of vegetables or grains between the trees when young.

It is an unworthy ambition of the orchardist to seek to make the orchard pay its way before it comes into bearing unless he knows how to accomplish the feat without mortgaging the orchard's future. There is such a thing as profitable intercropping. The vegetable grower often practices it, but he knows that it means loss unless tillage is perfect and the supply of food and moisture are sufficient. It is easy, moreover, for him to see when he has gone beyond the danger point and to reform his practice if need

be. The orchardist, on the other hand, may so deplete his soil by a few seasons of injudicious cropping that a decade may be required to repair the damage. One cannot afford to take chances in doing anything in the early years of the orchard which may lessen its productiveness in the future.

There is only one safe course in starting an orchard, and that is to take nothing from it at any period of its existence but fruit. Do not pasture the orchard, nor make a meadow of it, nor a cornfield, nor wheat field; in fact make nothing but an orchard of it from first to last. This is the safe course, even though intercropping may some time be allowable. One must furnish his own insurance in growing an orchard and he cannot afford to take large risks for the sake of small gains.

An interesting discussion might be started at this point as to what crops may injure and what ones may benefit a growing orchard; but there are some fundamental matters which need first consideration. A young orchard does not make heavy draughts upon the soil, but the demands increase from year to year until, at maturity, the trees consume annually approximately as much of the plant food elements as does a crop of wheat. It would thus seem easy to determine how much of nitrogen, potassium and phosphorus to apply each year. The problem cannot be stated in such simple terms, however. A complete chemical analysis of the soil, the trees and their yearly products would not reveal all that would need to be known. The physical as well as the chemical properties of the soil need to be considered. The water holding capacity of the soil; the temperature of the soil; the soil organisms, are some of the factors depending upon the supply of vegetable fibre or humus.

It does not seem necessary to discuss the offices of humus nor its importance, for every experienced tiller of the soil knows what its presence or absence means to the soil. Every good soil culturist seeks by crop rotation or manuring of some kind to keep up and add to the supply of vegetable fibre.

Is this the practice of orchardists? The best teachers of orchard culture have always insisted that cover crops should go along with cultivation, but it is an undeniable fact that there has been much more of burning up of vegetable fibre by intense cultivation than restoration of it by the plowing under of green crops "Dutch mulch;" "horse leg irrigation;" "grass mulch," are terms expressive of half truths which have been accepted by thousands of orchardists as the complete law and gospel.

Ask a culture crank if he believes in cover crops as well as in cultivation. He may say yes, and then proceed to show why, in his case, the former is less important than the latter. Believers in cultivation of orchards may not argue against cover crops but the fact remains that the majority do not make use of them. There are a great many cultivated orchards which are in precisely the same condition as are run down farms where the same crop is grown year after year and rotation wholly neglected.

My topic does not, however, relate to the management of old orchards but to those which are still young. The practice of continuous clean culture is even more prevalent with these than with middle aged and old orchards. A practice which is so prevalent must show somewhat of the opinion of those who follow it. If

almost every one who plants an orchard crop the soil to the extent of its capacity and makes but little effort to keep up the supply of humus it must be that the opinion is nearly general that such a course is not harmful.

Let us start with the self-evident proposition that the need of humus is greater in an old than in a young orchard. This being true the supply ought to be kept up in an increasing ratio. In practice this cannot well be done, for the cover crops which may be grown between the trees are in a decreasing ratio. We have then, two alternatives; to manure the orchard in its old age, or to fill the soil at the beginning as full as possible of humus, and to keep up the process as long as may be done without injury to the trees. That means to reverse the usual custom and instead of using up the humus as fast as possible hold it in reserve against the old age of the trees. According to this doctrine we ought never, at any period of the orchard's existence, allow the supply of humus to run low, even if cultivation must be diminished, temporarily, or suspended altogether.

No one will deny the need of humus during the productive years of an orchard, and the difficulty of adding to or keeping up the supply at this time is apparent. It follows, then, that to begin early to store it in the soil is the only logical course. Coupled with this must be an earnest effort to save from needless destruction that which is already on hand. Treat humus in an orchard precisely as an annuity, to be jealously guarded against the time when it will be needed most. One can no more afford to fritter away the humus in an orchard by trivial intercropping, and needless cultivation, than he can to put a bank deposit at the disposal of a spendthrift.

Doubtless my position on this matter may seem extreme and some of the statements made may be questioned, but it is hardly worth while to prolong the discussion on this point in view of the necessity of considering the practical details of conserving and increasing the humus content of the soil, while starting an orchard.

There are two methods of orchard management which are commonly regarded as opposite and antagonistic: viz., The grass mulch method and the cover crop and culture method. Formerly I believed fully in the cover crop and culture system and later gave my preference to the grass mulch plan, at least on hill lands, but now the good points of both seem to be about equal. I would adopt either one, or a combination of both, to suit the circumstances and conditions. Both are good, if suitably adapted to the conditions and properly carried out, which unfortunately is not often done.

A cover crop is required by both methods. One involves tillage and the other substitutes a mulch for culture. To start an orchard properly according to the grass mulch method a well seeded tract should be selected, and preferably one in pasture, and to specify more particularly, an old pasture; the best of all being one which was seeded when the timber was cut and never plowed.

Dig holes in the grass two or three feet across and place a liberal mulch about each tree as soon as planted. Mulch each year, gradually extending the circle, keeping out a little beyond the spread of the branches. Mow the grass once or twice each year and if the growth is sufficient it may, for a few years, be gathered and placed

about the trees, but it is better to bring in from outside as much material as is needed for mulching, to the depth of three or four inches. In no case should the grass be removed from the orchard. Stimulate the growth of grass so as to produce on the ground as much material as possible for mulching. A little manure or nitrate of soda spread broadcast may be helpful.

In case of thin soil it will not be possible to get a satisfactory growth of grass without the use of some manure, but the aim should be to grow grass, taking care, of course, by mulching, to prevent harm to the trees by the grass. The young trees do not suffer in any way but make a satisfactory growth and come early into bearing. The uniform condition of the soil about the trees as to moisture and nitrates is remarkable. There is much that may be said, pro and con, regarding the merits of this method, but the unity of my paper would suffer by taking up the argument.

There is only one thing to be considered here and that is the undeniable fact that while the trees are young and are making very light demands upon the soil, there is a gain rather than a loss in fertility. The humus supply is increasing rather than diminishing. It may be objected that it is a waste to allow the soil to stand almost idle for nearly a decade. We have no right, however, to charge any more than rental value of the land to the orchard in addition to labor and material. If we should charge the net value of the crops which might be grown, then the fertility which has been taken must be charged against the crops. We must go further than that and insist that after the cropping, all of the fertility which has been removed must be returned to the soil. Let any one plow up an old pasture or a good meadow and crop it for ten years, leaving it as good as he found it. If he accomplishes this he will practice better farming than do most orchardists who crop the soil in their young orchards.

My contention against the cropping of young orchards, is not to oppose the practice itself, but to object to the method which robs the future for the sake of the present. An orchard is not well started unless its future is fully considered. The only reasonable and safe attitude which one can take who proposes to crop his young orchard is to place the needs of the orchard first and the crop second. He must look ahead and consider carefully what effect the present management will have upon the orchard. Half of a ten year old orchard at the Ohio Experiment Station has been in grass, and the trees mulched, since planted. The other half has been managed according to the cover crop system since the beginning. It was intended that the cultivated portion should be divided and half devoted to ordinary cropping and the other half given over to the cover crop system pure and simple. There is some slope to the field, however, and washing began to take place on that portion where no crop was standing in the winter. It was, therefore, found advisable to change the plan so as to include all of the cultivated portion under the cover crop system of management.

The plan which has been followed thus far is to sow soy beans in drills two feet apart, about the first of June. The beans are kept cultivated until August, when rye is sown, to be plowed under in the spring. The soil is rather thin and the beans have not been cut but allowed to stand over winter. Had the soil been very poor

a better plan would have been to plow the beans under before sowing the rye, but they have served to keep the soil from washing, and apparently it has not been necessary to plow them under, for the benefit of the trees. Buckwheat or oats might have been substituted for the beans if the soil had been very fertile. Crimson clover, or some other legume might have been substituted for the rye a part or all of the time, but no reason for a change has been discovered. The trees are in good condition and have begun to bear. There is no evidence of too much nitrogen. As shown by the crops the soil is steadily improving.

Could not the same results have been secured by taking off some cash crop? On this particular soil the case would have been somewhat difficult; the nearest approach being potatoes, using a fertilizer high in phosphoric acid, following with crimson clover or rye. Our experience with crimson clover has not been such as to warrant placing much dependence upon getting a stand, nor has vetch proved reliable. Field beans might be used in place of soy beans, and rye sown after the beans are harvested.

On most soils a money crop might be secured each year and some crop plowed under each spring. It ought to be a settled policy to have some crop standing on the land over winter. It ought to be an almost invariable rule to plant the summer crop in rows to admit of cultivation, for the purpose of conserving moisture. If the plan is varied, as for instance when a crop of red clover is grown to plow under, then let the trees be mulched during that season. If, also, soy beans or cow peas are sown broadcast mulching ought to be attended to.

I am not prepared to say whether or not some of the leguminous crops may or may not be made into hay and removed from the orchard. The roots and stems of these crops constitute so large a portion of their value that it is possible that the tops may be spared from fertile soil. At least, for a short period, the plan may be practiced without loss. It is a common practice among orchardists not to grow a summer crop, but to keep the soil clean by cultivation. If one is studying his orchard he is likely to know whether it needs more nitrogen or if it is suffering for water. The practice of growing cover crops for the benefit of the orchard admits of great variation, and there is need of careful study of all the factors involved. It is possible by the use of leguminous crops and cultivation to increase the supply of nitrogen beyond the needs of fruit trees; causing too rank a growth and preventing coloration of the fruits. This does not necessarily mean that there is too much humus in the soil nor that the practice of turning under of green crops is to be discontinued. It means that the kind of green crop is to be changed. It means that the kind of green crop is to be changed and cultivation lessened.

On this matter there is much misconception and, in consequence, error in practice. It should be remembered that cultivation sets plant food free and conserves moisture. The first of these offices is less important in a young orchard than the second. Cultivation should not be haphazard nor excessive, and should be so regulated as to prevent loss of moisture, for the most part.

Just here is the weak point in the common practice. The soil is often kept bare in the early part of the season and thorough

cultivation kept up. This goes beyond the necessities of case with young orchards. Cultivation for the purpose of saving moisture is not to be timed by the calendar, but is rather to be regulated by the weather. After each rainfall, even though slight, the soil is to be stirred and just often enough to break the crust and to keep the surface mellow. More frequent stirring of the soil than this, if given without reference to the conditions, may accomplish no more in conservation of moisture and yet burn up more humus. It is the recklessness regarding the humus supply which needs reformation. In the case of young orchards there is, in the first place, too little thought as to how to get humus into the soil, and after that how to conserve it. The conservation of moisture is not to be considered more than that of humus. In other words, there needs to be a much nicer adjustment of processes in conserving both water and humus. The culture side has been put too constantly forward, and only half of the conservation side has been considered.

It is easily possible to force a young orchard into too succulent a growth by injudicious tillage. This is commonly understood with reference to tillage late in the season, but when clean culture, with no crop growing between the trees, is carried beyond the necessities of preventing the waste of moisture there is, beginning with warm weather, a notable increase of nitrates. All orchardists will agree that, at the beginning of the bearing age of any kind of a fruit tree, the nitrogen supply should be limited.

Tardy bearing is sure to result if fruit trees are forced when the fruit buds are forming. In tilled orchards the nitrates begin materially to increase early in June, in this latitude, and do not greatly diminish until cool weather comes. In mulched orchards the nitrates are less abundant at this time and are more uniform in quantity. This may explain why mulched trees in grass begin bearing earlier than those under cultivation.

The inference is plain; there ought to be a crop on the land all of the time to take care of the nitrates, and that cultivation should be mainly to conserve moisture. The theories which have been promulgated regarding tillage and cover crops are not founded upon sufficient data. They are not well balanced. There are facts coming to light which will compel a revision of the views now held and a restatement of theories, not only regarding tillage and cover crops but of mulching as well. The practices in vogue do not, however, match with the theories, in many cases. In my own state the usual custom in the peach region is to practice clean cultivation during the early part of the season and then for a cover crop allow the weeds to grow. The country over this custom is more prevalent than any other.

The next most common practice is to cease cultivation early and then to sow a cover crop. Where grass is used as a cover crop it is, for the most part, pastured or made into hay. Mulch, when used, is put near the trees, and commonly the grass is taken from the centers for this purpose. It looks, after all, as though no one has a very firm belief in the theories anyway. Not, at least, what might be called a saving belief. It seems to me, at present, if we accept as a fundamental doctrine that humus should be formed and conserved to the greatest possible extent in the early years of the

orchard that there is little need of doing more than to modify our practices according to circumstances.

So far as I know there is nothing in this method which may not be applied to any kind of fruit trees. A peach tree is not to be treated precisely the same as an apple tree, nor is any class of trees to be managed the same on all kinds of soil. There is no reason, however, to say that one kind of tree should be mulched and another cultivated, nor that a certain kind of cover crop is to be used exclusively on particular species of trees.

Aside from cultural methods there are many other matters to be considered in starting an orchard. The choosing of an orchard site; the preparation of the soil and planting of the trees will not be discussed, and the selection of varieties must be left out. One ought to take two or three years to get ready to plant an orchard. He must study soils, varieties, methods, and markets, and inform himself as to the best place to buy trees. The last item is not mentioned because I have lists of honest nurserymen and truthful agents to hand out, but for the reason that it takes some time and tact to get results in that line.

One needs, first of all, to get acquainted with an intelligent and reliable nurseryman. There is no need of scraping acquaintance with tree agents or dealers unless your wits need sharpening or you are hankering after experiences of all kinds which are thought to be necessary to make a trained horticulturist. You must, however, hunt until you find a nurseryman who is just as anxious to do you a good turn as he is to take your money. If you cannot find that kind of a man of whom to buy them grow your own trees and propagate from the best bearing trees that you can find. When buying trees take them not according to height and caliper but as to age. A one year old peach tree, and others one or two years, according to the way they have been started in the nursery, or how you expect to handle them. If you want a tree with a low top you may have to take a yearling tree as the two year old trees may have too high a top. If you believe in planting corn in your orchard the first year a two year old tree is better than a one year old. If you accept trees according to size you may get old stunted trees that are no larger than good two year olds should be. Better get the largest and finest trees in the nursery, of a given age, even at two prices, than to accept culls of uncertain age and low vitality.

It is really a profitless discussion to give pros and cons as to age and size of trees to use. A good orchardist will choose a good tree of the size and age which suits him and he will get results, no matter what the size and age. One thought about the preparation of the trees for planting is sufficient. A vigorous fresh tree will grow, even if not pruned at the time of planting, but some shortening of both the top and roots is advisable, and very severe pruning may be practiced if desired. If the top is cut back to a mere short stub and the roots left in the form of a club, with nothing but a main stem eight or ten inches long, and put into a hole made with a crowbar there need be no fear as to the result. But insist that the nurseryman deliver all of the top and root intact, as then you will see what you are getting. If he sends trees with crown galls on the roots you can either burn or send them back.

The distances of planting and the use of fillers are likely to be disputed questions for a long time. We thought that we had this

matter pretty definitely settled, but there is now a marked tendency to closer planting and heading in. As applied to peach trees, this plan appears to have merit, for they are amenable to severe cutting back. In the West, apple trees are treated after somewhat the same manner. The planting is much closer than in the East. The practice of using fillers in an apple orchard has more advocates than formerly. Beginners are usually more in favor of it than those who have had experience, but of the latter class those who feel themselves competent to destroy trees when need be, favor some plan of close planting, with a view to thinning.

There are possibilities in close planting, and yet there is danger in it. It is a matter which will not down and it must be studied and discussed. As to the ability of the soil, under good culture to sustain, for a reasonable period, from two to four times the number of trees which are to stand permanently there can be no question. The danger is not in overtaxing the soil and of robbing the permanent trees of food. The injury to the permanent trees is more likely to occur because of shading, causing, or forcing, the trees to run up to too great a height. This may happen before the owner is aware that crowding has occurred. Then too, the fillers shade the cover crop and check its growth, thus reducing the supply of humus. It is apparent that the fillers are thus indirectly robbing the permanent trees. If varieties having a small top are chosen for fillers the danger is lessened, but most of the sorts which begin to bear at an early age are vigorous growers.

A comparatively safe plan in an apple orchard is to plant the permanent trees 35x40 feet apart and then to put in an equal number of fillers, such as Yellow Transparent and Wagener, so that the trees stand 20x35 feet apart. This plan admits of room for spraying operations and avoids, to a great extent, the danger of too close planting. The use of peach trees as fillers in an apple orchard is open to objections, aside from those enumerated. The treatment of the two kinds of trees is often different and causes may often arise where one or the other might be greatly injured by the same course of management. In any case the peach tree is too gross a feeder to be planted with apple trees, and it will be found to greatly interfere with any well planned course of apple orchard management. To say the least a young apple orchard having peach trees in it is exposed to very great danger. The pruning of a young orchard is simple but important.

High headed trees are less in vogue than formerly and with their passing we have less trouble to keep our trees from leaning and becoming lop sided. If we see that three or four good branches start out at different heights around the main stem and are kept about equally balanced there is not much more that really must be done. It is well worth while, however, to shorten in these branches each spring. This cutting back may be regarded as essential to peach trees; very useful in the case of all dwarf trees and of considerable advantage to apple trees. It is done with peach trees to prevent over bearing and breaking down, to keep dwarf trees in shape and to secure good thick strong branches on apple trees.

A peach orchard is not up to date unless the trees are cut back every year. If labor were easier to secure and to train it would

be a good investment to do much more careful pruning and shaping of our apple trees. The branches might be better placed; made thicker and stronger and better exposure of the centers of the trees to sun and air made possible. Considerable pruning in future years might also be avoided by doing more in the early life of the trees.

In this discussion, an effort has been made to elucidate certain features which hitherto have not been given a fair share of attention. If the ideas advanced have no other effect than to awaken thought and lead to deeper study as much good will be done as can reasonably be expected.

SPRAYING, THE SHEET-ANCHOR OF SUCCESS

By DR. J. H. FUNK, *Boyertown, Pa.*

Mr. Chairman, Ladies and Gentlemen, Fellow Farmers and Fruit Raisers: I feel it an honor to stand before this assembly this evening; but I must admit it seems somewhat mysterious why I am put upon the program annually to talk before the intelligent audience that compose the State Board of Agriculture and my fellow-lecturers. And were it not for the fact that our worthy Deputy Secretary of Agriculture is very fond of a joke it would be difficult to ascertain the reason.

I feel somewhat lonesome, and am placed in the position of the German soldier, who, in the quiet hours of the night was visited by a polecat, who let his presence be known in his own characteristic manner; finding that his tent-mates were all asleep, exclaimed: "Mine Gott! I haf to schmell it all mine self." I will endeavor to do my best in a very brief manner.

Emerson says, "The man who writes a better book, or makes a better mouse trap than his neighbors will find the world making a beaten path to his door." I am not going to write a book, neither am I going to make a mouse trap, for I have a beautiful yard covered with a rich carpet of grass, and I do not want it trodden down. But I will give you some of my practical experience with spraying that may be of benefit to at least a few of you.

Spraying, from some cause or other, is more neglected or less understood than any other important factor in fruit raising. And yet in these times of insect depredations and fungus, and bacterial diseases, it is pre-eminently the most essential of all means employed in the production of choice fruit.

So necessary has good spraying become in order to obtain good fruit, that many have fallen into the error of thinking that spraying is all that there is to fruit raising. We must not cease to remember that however important spraying is, it is only one of the factors, pruning, fertilizing and cultivation are all so closely allied that entire success depends upon their joint efforts. Any one of

these last may be occasionally omitted; but spraying is an absolute necessity, for what availeth it if you raise a large crop and lose it through a worm hole.

In this talk, I will not enter into details as to the great value of spraying; we are past that stage. There are few that do not believe in the value of the copper salts, or the compounds of sulphur as fungicides, or the arsenates as insecticides and the emulsions for sucking insects. There are many who do not spray, but the practice is giving such good results that there is an annual increase in the number of those who thoroughly spray their trees. So it is no longer a question as to whether it is good, but how, when and with what to do it. Sometimes we hear of unsatisfactory results, but it is not the fault of the system, but the improper preparation or application of the same. One must familiarize himself with the nature and habits of the organisms he wishes to destroy. To perform an operation intelligently you must thoroughly understand the reason why you do it, otherwise success is merely accidental. You need not necessarily know all the diseases by name or the life history of every insect, but the more you do know about their origin, their methods of propagation, where they pass the winter, whether in the egg, larva, pupa or in the perfect form, when they appear in the spring, how they affect the tree, plant or fruit, whether by eating or by sucking, the more you know of these facts the better you will be prepared to attack them in their most vulnerable form.

Most of the fungi are internal parasites, they must be attacked in the spore stage. Spraying for fungi is more largely a preventive than a curative measure. Spraying for insects and fungi is a form of insurance whereby the grower may secure larger crops, of finer, brighter and firmer fruit, possessed of higher quality than could otherwise be obtained. By spraying, the benefits are plainly seen by the increased health of the tree or plant, the foliage being thicker, richer in color, and free from fungi, thus enabling them to perform their functions of preparing plant food. Should a tree from any cause become defoliated, it loses its power of assimilation and preparing the food for the tree bud and fruit. It carries its influence farther, preventing the premature dropping of the fruit.

Spraying is, to a certain extent, cumulative, its benefits are not all seen the same year of application. This would of course not hold good with plants that grow their stock, develop their buds and mature their fruit the same season, such as the annuals. But with all trees that form their buds the previous season, such as the apple, peach, etc. Spraying is not a panacea for all the causes of failure with fruit raising. It will not take the place of pruning, fertilizing, or cultivation. An orchard that is unproductive from neglect, lack of tillage or worn out soil, cannot be made productive by spraying alone, but it is one of the essentials.

Thoroughness

There are many failures from lack of thoroughness. A tree or plant need not be sprayed until it drips from the foliage and runs down the limbs and trunk, but every part should be thoroughly moistened. Another cause of failure, is the use of the wrong material, a fungicide is often used for insects, and an insecticide is

used for fungus diseases. The method of combining ingredients must be understood, or the preparation used is often valueless, and time and material lost with little or no benefit. This is often the cause of failure with lime and sulphur, in destroying the San José Scale. Another cause is the application is made at the wrong time, too early or too late (time and material will be given under the head of Insects and their Treatment).

Apparatus

It is necessary to have a cooker of sufficient size, several barrels or tanks, and a good strong pump that will give a pressure of 100 to 150 pounds pressure. Only large size barrel pumps, with a large air chamber, and a long strong handle is capable of giving and maintaining this amount of pressure. This should be firmly attached to a barrel or tank, mounted on a wagon or sled. The air chamber and working parts should be inside the barrel, with the piston at the bottom, when it is always primed ready for work thus saving considerable pumping, and at the same time placing the weight low down, making it less liable to upset. Such a pump is sufficient for an orchard not exceeding five to ten acres. Most outfits are furnished with too short a hose, being impractical for doing good work. Not less than forty feet should be used, and fifty feet is better. There should be an extension pole of eight or ten feet, with a good leakless valve at the bottom with good large nozzles attached at the upper end with a bend or angle thirty-five or forty degrees that the spray may be conducted downward into the calix cups.

For orchards of larger dimensions some good power outfit is essential. There are many good power sprayers on the market for the orchardist to select from. Were it not for the deterioration of the lime-sulphur mixture, I would prefer the gas sprayer, it is one of the best powers, prompt and uniform in its action regardless of the number of nozzles in use. But the Carbon Dioxide renders the spray useless for the destruction of the San José Scale. Compressed air is another power that is giving very good satisfaction.

The gasoline engine power seems to be the general favorite, as it gives sufficient power for all purposes, and when not in use as a sprayer the engine can be used for other work on the farm. The one drawback has been that all of the gasoline powers, they require a safty valve to relieve the pressure when the nozzles are closed, returning the liquid to the tank. This is all right as long as the valve lasts, but unfortunately the lime-sulphur solution returned under pressure soon wears away the seat of the valve and it must be reground or a new one put in its place, this is both annoying and expensive. I know of but one maker that has overcome this difficulty, they have a regulator placed between the tank and the pump. It has a piston that is acted upon by the back pressure whenever the nozzles are closed. You set this regulator by a screw at any pressure you wish up to 200 pounds if desired. When the nozzles are closed the back pressure lifts the piston contained in the regulator and cuts off the supply to the pump and lets the engine run empty, thus using less gasoline and relieving the machinery of all strain. I have used one of these regulators this season and it works like a charm. The only objection to this is

its expense, costing $20.00. If the trees are tall a tower is a great convenience and causes better work to be done, as the operator can stand above and throw the spray downward into the calix cups.

As to the stationary part of a spraying outfit, is very important if the orchard is of good size to have a building of sufficient size to cover a boiler, cooking tanks, mixing tanks, various materials to be used in the compounding of the various spray mixtures. If this can be located on a side hill, that elevated platforms can be had, that the material can be run by gravity from the cooking tanks to the graduated dilution tanks, from there to the tank on the wagon. This does away with much of the heavy and disagreeable part of the work. Then if you have an elevated tank or reser voir to hold the water supply much time and labor is saved. Many of these conveniences can be had with but little outlay of money, and spraying will no longer be the disagreeable work of the past.

Material

I do not wish to condemn any material, or do I wish to advertise any article manufactured and placed upon the market. But my firm conviction is, all things considered, that the lime and sulphur solution, when properly prepared, is the best and most economical spray of the present time. It is one of the best we have for San José Scale, it destroys the eggs of the Tent caterpiller, canker worm and many other insects that are injurious to our trees. It is one of the best fungicides that we have. It is a specific for Peach leaf curl. Then as a summer spray it is taking the place of the copper salts, being cheaper and better as it does not injure foliage or russet the fruit, and if one of the arsenites is added it does the work of the two with but one operation.

As to whether the Commercial, or the home-boiled shall be used, depends upon conditions. For the farmer who has but small orchards, or is not prepared to cook the material, the Commercial solution is more convenient and I believe more reliable. But for the man who has large acreage the home-boiled is much cheaper, if he has the proper outfit he can manufacture it for about one-third the cost of the commercial, or one cent per gallon. The formula for the home-boiled is thirty pounds sulphur, forty pounds lime, 100 gallons of water.

This can be used only on dormant trees. If the Commercial solution is used it must be of sufficient strength. As recommended by the manufacturers, one to eleven is too weak; it should be one to eight, at which strength I find it to give satisfaction. As a summer spray it must be diluted about one to forty or one to fifty, this is for apple, for peach this is too strong, I have known heavy losses to occur from using this strength. In fact, I consider it unsafe to use on the peach as a summer spray. As a summer spray for the peach I use the self-cooked, using ten pounds sulphur, fifteen pounds lime and 100 gallons of water. For the apple I use sixteen pounds sulphur, twenty-five pounds lime to 100 gallons of water. This strength is safe, and I believe it will in the near future supercede Bordeaux mixture as it does not russet the apple as does the Bordeaux mixture, and when used on peach as soon as the calix drops from the small peach it reduces fungi to a minimum, and when arsenate of lead is added it destroys a large part of curculio. It appears that the arsenate of lead also possesses fungicidal proper-

ties, and if used when the fruit is nearing mature size it tends to aid in the coloring, and preventing the manilia, or brown rot which in some seasons causes heavy loss.

How Often Shall We Spray and When

Ordinarily three times is enough, occasionally four times is better. 1. Either in the fall as soon as the petals drop, or early in the spring before the buds expand sufficient to be injured. For apple, I believe the fall spraying is the best. We generally have more time, the weather is usually more favorable, we are not troubled with such strong winds. In the spring we frequently have strong northwestern winds for a week or ten days at a time, and very few days with the wind south or southeast. Thus we often find it difficult to spray the tree on both sides. Fall spraying has another advantage, we catch many of the lice crawling about having no protection and so are easily destroyed. And the tree suffers less than if they were feeding upon it during late fall and favorable weather in winter. For peach I prefer spring spraying, as one application answers for the Scale, and as fungicide to prevent the leaf curl.

2. Spraying depends upon conditions. Some seasons we have an epidemic of Aphis, like the season of 1909 when the foliage and fruit of the apple was seriously injured all over the country. For these pests we spray with one of the emulsions, just as the buds begin to open and the small leaves are forming.

3. Spray, as soon as the petals drop, or inside of ten days. At this season the calix cups are standing erect and open in the most favorable position to receive the poison. At this time by spraying from above downward with a good pressure some of the poison will be forced into the cups, but if left later the sepals close and no poison can enter. This is important as from seventy to eighty per cent. of the larva of the codling moth enters the fruit from the flower end. If this contains poison the small worm takes its first meal and perishes.

4. Spraying should be about twenty days later. Many bulletins recommend ten days after the petals drop, but this is too early, as it is seldom that any young larva are hatched before July, as the life history of the insect shows. The larva passes the winter in the cocoon in some secluded place. During May the larva opens the end of the cocoon and spins a silken tube to the surface, then returns to the cocoon with its head to the opening, and sheds its coat, and transforms into a pupa, which is its dormant stage, during which time it goes through most wonderful changes from a worm into a winged moth. This transformation averages about sixteen days, time depending upon the weather. At the end of this time the pupa wriggles out of the cocoon, this takes place from the 10th to the 20th of June. If the weather is warm the moth begins laying eggs in five or ten days, and die in a couple of weeks. So the eggs are laid the latter part of June, or the beginning of July. The eggs hatch in five or ten days. So it is seen that in average seasons, the eggs do not hatch inside of a month after the blossoms drop.

Now, as the eggs are laid, many of them upon leaves some distance from the apple, the small worm eats its first meal from the

tender leaves, and if these are coated with poison it is killed before it reaches the apple. And if this poison is put on shortly before the egg hatches it is less liable to be washed off. Should the larva escape, reach and enter the calix and this is poisoned its career is ended. Otherwise it enters the apple and feeds upon the seeds preferably. In twenty-five or thirty days it attains full size, eats a hole out and crawls to some secluded place and pupates. Some of the earliest ones mature and lay eggs this same season giving the second brood. These are the worms found in the apples at gathering time. To catch these spray in August, and if a fungicide is added to the insecticide, it has a tendency to keep the foliage clean and healthy, thus adding to quality of the fruit.

I consider three times spraying sufficient for the apple. First, for scale; second and third, for the Codling moth, curculio, canker worms, and other insects, as well as for fungus diseases. In the season 1909 my fruit was so clean that six men hunted for three hours to find a wormy apple without finding one.

The last of my fruit was sold May 20th in the Philadelphia markets, at prices ranging from $4.50 to 6.00 per barrel which testifies as to cleanliness and quality of my fruit. Out of the many hundreds of barrels of apples, there was not one that needed repacking. For home use I keep them in a cave and expect to have until July.

I prefer spraying my peach in March, with lime and sulphur, full strength, for the scale. I gave them their second spraying with self-boiled lime and sulphur May 14 to 18, using formula, 15-25-150, with six pounds arsenate of lead. My next spraying will be sometime in June after thinning is done. My third spraying will be with the same material. This will be for control of fungus diseases such as fly speck fungus, wilt, etc. Since I have been using the lime and sulphur sprays I have not been troubled with Manilia, or Brown-rot.

I am often asked if the Bordeaux mixtures are not safer and more reliable. Perhaps on the apple it may be just as good, if you are satisfied with russetted fruit. I have never been able to use it dilute enough to benefit and not injure. The peach is especially susceptible to injury by the copper sprays, no matter how dilute.

Recapitulation

Train your trees low.

Keep heads open by judicious pruning.

Spray while trees are dormant.

Cover every trunk limb and twig.

Use a good spray suitable to the occasion.

Spray as soon as blossoms drop.

Use a combined Fungicide and Insecticide.

For Masticating Insects use Arsenate of Lead.

Spray twenty or thirty days after blossoms drop. Use the best equipment obtainable. Use a high pressure. Spray from the five sides, north, south, east and west, then from the top side.

Spray at the right time, with the right material, in a right manner, and 95 per cent. of the fruit will be clean, and your success will be assured.

FERTILIZATION AND CULTURAL METHODS FOR APPLE ORCHARDS

By PROF. JOHN P. STEWART, *Expt. Hort., State College, Pa.*

It is my purpose to-night to bring before you results which have followed certain orchard treatments in this State and also in others.

We have not reached our present knowledge of orchard fertilization by progress in a straight line. At first, apple trees were run on the forest plan. Fertilization was not considered. The trees were grown apparently under the impression that their demands were small and their roots were deep and hence were surrounded by virgin fertility and largely inaccessible anyhow to surface applications.

Then in 1895 came the work of Director Roberts, of Cornell, in which after a chemical study of a couple of trees he concluded that an acre of apple orchard in full bearing annually removes nearly three times (2.94) as much plant food as fifteen bushels of wheat.* Many similar studies followed,† the movement culminating in the extensive report‡ of the Geneva Station in 1905, in which the plant food constituents of all the ordinary tree fruits were given. The feeding area has also been found to be comparatively shallow, so that from these studies alone the conclusion was inevitable that a mature-bearing orchard is at least as exhaustive as any ordinary farm crop and hence should be as regularly fertilized.

Along with the chemical movement, but reported later, came what might be called a preliminary series of field trials. Fertilizers were applied for various purposes, in some cases to improve color, in others for scab, and in a few cases to affect yield. Scab and fertilizers were found to be apparently unconnected. Color showed no consistent improvement from either iron sulfate or potash. In one instance, phosphates greatly improved it,§ and nitrates, wherever reported, strongly diminished color. On yield and growth, varying results were obtained, the most consistent gains in the earlier experiments being made by nitrogen,‖ with one improvement reported from potash and none from phosphates alone. Most of the experiments comprised but few trees and were of short duration. Their effect, however, in spite of some inconsistencies, was partly to confirm the conclusions of the chemists, at least in respect to the necessity for certain elements.

Then came the reports of the long-time experiments, one in England at the Woburn Experimental Farm** and another at Geneva, N. Y.†† In them, little effect was observed from the fertilizers applied, and serious doubt was cast on the value of fertilizers in apple-production.

*Amount removed in fruit, leaves and wood. Cornell Bul. 103:537-40. The statement is true if the straw is not included. Including the straw, the relation is somewhat less than twice (1.93-) the food removed by this amount of wheat.

†The results of some of these are presented by Shutt in the Canada Experimental Farms Report, 1896, 164; others in Missouri Station Rpt. 1896, P. 77; and by Browne, Jr., in Penn. Dept. of Agr. Bul. 53.

‡New York Geneva Station, Bul. 265:220. 1905.

§Experiment at Wye College, England.

‖Gains are reported from nitrogen in Cornell Bul. 153, in Mass. Bul. 66, and in Maine Bul. 139:53. In the Cornell experiment, nitrates applied on August 11, 1894 are reported to have failed to show important effects until the season of 1896, although the ground was tilled.

**Reported in 1900.

††New York Geneva Bul. 289. 1907. Nitrogen not applied.

Affairs were in this condition, when somewhat over three years ago the experiments now in progress were undertaken by your Experiment Station at the request of your leading horticultural interests. Already some marked results have been secured, which enable us to see a little farther into the problem, and to account for some of the earlier unfavorable returns. In the meantime, favorable results from a long-time experiment in Massachusetts have appeared to which attention is given later.

THE PENNSYLVANIA EXPERIMENTS

With the scope and general character of our experiments, you are already acquainted. But I would recall the facts that we have under experiment in various parts of the State ninety-one acres of orchard, forty-nine of which (including 2,219 trees) are in partial or full bearing. The yields from these experimental orchards in 1908 were somewhat over 164,000 pounds of fruit, and in 1909, the third year, they were 256,000 pounds. The data for the tables and conclusions which follow, therefore, cover a period of three years and are derived from something over 420,000 pounds of fruit. The exact locations, soil types and varieties involved are shown in Table I.

TABLE I

Location, Soil, and other Data on Experiments away from the College

Expt. No.	County.	Owner of Orchard.	Soil.	Varieties.	Age, 1909. Yr.	No. of trees.
215	Adams,	Tyson Bros.,	Porter's loam,	York Imperial and Stayman Winesap,	10	160
216	Franklin,	D. M. Wertz,	Mont Alto fine sandy loam,*	York Imperial and Jonathan,	10	160
220	Bedford,	Mrs. S. B. Brown,	DeKalb stony loam,*	York Imperial and Baldwin,	11 & 21	160
217	Franklin,	J. H. Ledy,	Mont Alto loam,*	York Imperial and Gano,	16	358
218	Franklin,	J. A. Nicodemus,	Hagerstown clay loam,*	York Imperial and Albemarle,	10 & 14	400
219	Bedford,	J. R. Sleek,	DeKalb shale loam,*	York Imperial, Jonathan, Ben Davis and Gano,	7	320
221	Wyoming,	F. H. Fassett,	Fine sandy loam,†	Northern Spy and Baldwin,	37	115
336	Chester,	A. D. Strode,	Chester loam,	Grimes, Smokehouse and Stayman Winesap.	7–9	‡120 & 105
§337	Mercer,	St. Paul's Orphans Home,	Volusia silt loam,*	Northern Spy, Baldwin and Rome,	2	180 & 180
338	Lawrence,	J. B. Johnston,	Volusia silt loam,*	Baldwin,	21	80 & 105
339	Bradford,	F. T. Mynard,	Upshur loam,*	Baldwin and Fallawater,	15	120 & 16

*Soils un-mapped as yet but probably closest to the types indicated according to the observations of C. F. Shaw and H. J. Wilder.

†This soil has received no series name but it is one that has been deposited in a lake bed formed by the temporary stoppage of the Susquehanna in cutin through the mountains.

‡In the two sets of figures in this and the following experiments, the first gives the number of trees under fertilizer treatment, the second those under differing cultural methods. In experiment 339, the latter includes only a sod mulch plot.

§Trees set out in connection with these experiments, hence not yet in bearing

The first three experiments, 215, 216 and 220, comprise what we call our straight fertilizer experiments; the next four are experiments on cultural methods, with and without manures; and the last four are a combination of fertilizer and cultural methods experiments.

Each of the fertilizer experiments contains sixteen plots of ten trees each. The treatments are shown in Table II. The symbols N, P and K refer to nitrogen, phosphates and potash; and they are applied at the rates of fifty pounds N., 100 pounds P_2O_5 and 150 pounds K_2O per acre in all cases. Plots 5 and 6 compare the muriate and sulphate as a carrier of potash. Plots 11 and 12 compare acid phosphate and "floats" as a carrier of phosphoric acid (phosphorus pentoxid, more correctly). The manure was applied at the rate of twelve tons per acre and the lime at 1,000 pounds per acre. All applications are made annually.

The combined results to date of the first three experiments are shown in Table II:

TABLE II

Influence of Fertilizers on Yield, Color and Growth

Expts. 215, 216, 220

Plot.	Treatment.	Yields, 1908-9., lb.	Per cent. of benefit on yield.*	Yields 1909, 3rd year, lb.	Per cent. of benefit 3d year.	Per cent. of apples colored one-half or more,† 1908-9.	Per cent. of benefit on color.	Average increase per tree in trunk girth, in inches, 1907-9.	Per cent. of benefit on growth.
1	Check,	4,643	--------	1,306	--------	69.2	--------	3.29	--------
2	N. P.,	6,887	78.1	1,770	51.2	47.9	-22.5	3.54	8.9
3	N. K.,	5,653	82.8	1,409	36.4	57.	-14.5	3.63	19.1
4	Check,	2,313	--------	897	--------	72.7	--------	3.18	--------
5	P. K.,	3,577	62.5	1.441	56.5	69.8	1.7	3.54	3.8
6	PK_2SO_4,	2,773	32.	1,664	76.3	67.2	3.6	3.43	5.1
7	Check,	1,998	--------	1,067	--------	59.	--------	3.29	--------
8	N. P. K.,	3,847	67.4	1,561	31.3	41.6	-20.3	3.97	18.2
9	N.,	4,709	81.2	2,675	104.2	43.8	-21.1	4.08	19.4
10	Check,	2,898	--------	1,431	--------	67.8	--------	3.48	--------
11	Acid P.,	2,833	6.26	2,126	52.2	69.3	3.3	3.49	-1.7
12	Raw P.,	1,548	-36.6	1.073	-21.3	75.3	11.	3.29	-8.9
13	Check,	2,209	--------	1,327	--------	62.5	--------	3.68	--------
14	Manure,	4,793	138.3	3,423	178.5	56.0	-9.1	4.30	21.6
15	Lime,	1,538	-21-7	895	-21.	66.7	-.9	3.73	9.6
16	Check,	1,843	--------	1,034	--------	70.2	--------	3.26	--------

*The per cent. of benefit is obtained in all cases by comparing the "normal performance" of each plot with the results actually secured, the normal being obtained by comparison with the two nearest checks.

†In all these tables the effects on color and size of the fruit were obtained from random samples, taken from the fruit of each tree as it was weighed, the aggregate sample from each plot amounting usually to one or two bushels. The data on yield and growth were obtained by weighing all the fruit and measuring all trees twice.

Striking things shown here are the strong beneficial effects of manure and of nitrogen on yield and growth, with an accompanying harmful influence on color. Plots 6 and 11 show surprising gains

in the yields of the third year. Raw phosphate and lime continue to show deficits in every way except in color for the former and in growth for the latter. We can hardly see any reason for this harmful effect in the case of the "floats" and suspect that it is due to some temporary condition which will disappear later. The same may be true of the lime effect, though the reports of "lime poisoning" made by Dr. Headden in Colorado Bulletin 131 are worthy of consideration in this connection. It is also worthy of note that the plots which have made the best yield have also made the best growth, thus showing that reasonable amounts of yield and growth are not antagonistic but rather are associated.

A puzzling condition appears in the fact that wherever nitrogen has been applied in combination with other elements, the benefit decreases in the third year, while in Plot 9 where it was applied alone the benefit in the third year increases distinctly. This is partly explainable in the larger yields of the former plots last year, thus bringing them more strongly under the operation of the biennial bearing habit.

Also the difference in yield between 8 and 9 may be traced directly to a deficit of at least 1,000 pounds that occurred this year in Plot 8 of Experiment 220. This deficit was not due to the absence of apples on the trees. On the contrary an excessive number of fruits were formed on this plot, despite its heavy crop of last year, and this very fact, coupled with the excessive foliage and extreme drought of the current season, almost prevented development in the apples. Plot 9 was subjected to similar conditions but to a lessened degree in every way. Its original set of fruit and its foliage were less and its moisture situation is scarcely as severe as that of Plot 8. The indications on the present year's crop are that the plots receiving all three elements will regain much of their loss in relative position.

In Table III we have another set of results from the fertilizer portions of Experiments 336, 338 and 339, which have been running for two years only. The applications are the same as in the experiments above.

TABBLE III

Influence of Fertilizers on Yield and Color

Expts. 336, 338, 339. (a) Yields in lb., 1908-9

	1 Check.	2 N. P.	3 N. K.	4 Check.	5 P. K.	6 N. P. K.	7 Check.	8 Manure.	9 Lime.	10 Check.
1908, 1st year,	562	860	748	1,118	846	2,178	1,067	2,338	3,111	2,748
Per cent. benefit,*	----------	15.1	-19.8	----------	-23.2	100.9	----------	46.7	42.1	----------
1909 totals,	1,087	6,435	6,367	2,502	3,803	7,212	2,436	4,600	2,349	1,720
Per cent. benefit,	----------	312.7	213.6	----------	53.3	193.4	----------	109.7	19.9	----------
1909. (b) Color. Per cent. of apples Colored One-half or more.										
Average per cent. color,	57.2	40.-	39.8	49.4	46.5	38.0	49.7	49.0	50.3	54.8
Per cent. benefit,	----------	-14.6	-12.3	----------	-3.	-11.6	----------	-2.4	-2.8	----------

*The results of the first year were obviously unaffected by the fertilizer treatments, but they are included for the light they throw on some of the results of the second year, notably those in plots 2, 3 and 6.

In general these results corroborate those of Table II. The nitrogen plots show remarkable increases in yield; and the evil effects on color are less evident than in the earlier table. The lower benefit on yield in Plot 6 is due apparently to the relatively large yield on this plot the first year, coupled with a harmful influence which potash seems to be exerting in this series of experiments. Manure shows itself to be slower in action than nitrogenous commercial fertilizers. The absence of any well defined effect of fertilizers on the crop of the first year is evident here as usual. The lime again shows a very weak influence, and the relatively slight benefit that appears is probably due largely to a favorable location in one of the experiments, as explained later.

In Tables II and III we have had results from various combinations of fertilizer elements, as well as some from certain materials used singly. Those results being direct from the trees may be considered a close expression of the values thus far of the various combinations used. In many cases, however, we may wish to know which is the more active element in a given combination and approximately what values are to be assigned to each of the elements in it. For example, in Plot 2 of Table II we find a benefit of 78.1 per cent. resulting from an application of nitrogen and phosphate. Here the question arises as to how much of this effect was due to nitrogen and how much to phosphate. Any answer to this can be of course only as approximation of the truth and hence the values obtained and shown in the following table are not to be taken too literally. They are the nearest approach to the correct values, however, that we are able to obtain at this time and they were derived in the manner indicated in the footnote to the table.

TABLE IV

Influence of Fertilizer Elements on Yield, Color and Growth *

Estimated Per Cent. of Benefit

Expts. 215, 216, 220.	Yield.		Color. Growth.†	
	1908-9.	1909.	1908-9.	1907-9.
NITROGEN, in combination,	49.2%	15.55%	-19.35%	12.1%
NITROGEN, alone,	81.1	104.2	-21.1	19.4
Ave. influence of Nitrogen,	65.2	59.9	-20.23	15.8-
PHOSPHATE, in combination,	28.9	35.65	-3.13	-3.2
PHOSPHATE, alone,	6.2	52.2	3.3	-1.7
POTASH, in combination,	33.6	20.85	4.85	7.0
MANURE, alone,	138.3	178.5	-9.1	21.6
LIME, alone,	-21.7	-21.	- .9	9.6

TABLE 4—Continued

Expts. 336, 338, 339.	Yield.	Color.
	1909 (2nd year).	1909.
NITROGEN, in combination,	236.5%	-11.9%
PHOSPHATE, in combination,	76.2	-2.7
POTASH in combination,	-22.9	- .3
MANURE, alone,	109.7	-2.4
LIME, alone,	19.9	-2.8

*The results here given are calculated or taken from Tables II and III. For example, the value of nitrogen in combination was obtained by following the formula NP+NK—PK. In other words, the per cents. of benefit obtained in plots two and three were added and from this sum was deducted the per cent. of benefit in plot 5. The remainder, divided by 2, is considered to be the value of nitrogen in the combination. The other values in combination were obtained similarly.

†Per cent. of increase in trunk girth.

These results, being derived from those in Table II and III, are naturally not materially different, but the values of the individual elements stand out more sharply.

Nitrogen and stable manure show strikingly beneficial effects on both yield and growth and characteristically harmful effects on color. The effect of manure is greatest in the third year of the first three experiments, while that of nitrogen is astonishingly great in the second year of the three later experiments.

Phosphates are showing considerable value on yield, especially when used in connection with other materials. Their effect on color and growth is apparently undecided, as three per cent. variations from the normal are attributable to limitations in our methods of determining values. Potash, in combination, has shown fairly good effects on yield and growth in the first three experiments, but has apparently proved rather distinctly harmful on yield in the second three; and considering the results in all six experiments its value in improving color is very questionable.

Lime in the first three experiments shows a distinct deficit in yield, and no advantage in color, but apparently a fair increase in growth. In the other experiments an apparent benefit in yield is shown. This, however, is traceable to an unusual increase on the lime plot of experiment 339, an increase which was due probably more to a favorable moisture situation this year than to any effect of the lime. It is surely a significant fact that in five out of six places thus far, lime shows either no effect or a distinct deficit in yield.

It will be noted that practically none of the treatments have materially improved color while a number of them have distinctly decreased it. This reduction in color is undoubtedly associated with *delayed maturity* and a *diminished light supply to the fruit,* the latter being due to an increase in the density of foliage following the application of the fertilizers. The value of sunlight in developing redness in apples is scarcely appreciated. In a test conducted during the past fall on York Imperials it was found that exposure to sunlight after picking increased the redness by over thirty-five

per cent., while apples confined in the dark, or exposed to electric light and under identical conditions otherwise, showed practically no increase. *Maturity in sunlight* on the trees is undoubtedly the great influence affecting the red color of fruit, and when soil ingredients apparently affect it, the result is doubtless produced indirectly through a modification in the main influence.

In Table V, we have the "dollars and cents" value of fertilization as shown in some of our most striking results of this year.

TABLE V

Financial Value of Fertilization

Expt. 221, 1909 (3rd Yr.)	Yield, pound.	Bushels, per acre.	Value at 50 cents.	Cost of fertilizer.	Net gain per acre.
Unfertilized, plots 4 and 7,	19,448	194.5	$97 25	----------	----------
Com. fertilizer, plots 6 and 9,	47,028	470.0	235 00	$13 00	$124 75
Manure, plots 5 and 8,	48,550	485.5	242 75	15 00	130 50
Expt. 220, 1909 (3rd Yr.)					
Unfertilized, plots 13 and 16,	291	27.9	13 95	----------	----------
Manure, plot 14,	1,947	373.8	186 90	15 00	157 95
Expt. 338, 1909 (2nd Yr.)					
Unfertilized, plots 1 and 4,	2,607	156.4	78 20	----------	----------
Com. fertilizer, plots 2 and 3,	12,026	721.5	360 75	15 00	267 55

It is to be noted that the net gains are obtained after *deducting both the cost of the fertilizer and the value of the unfertilized crop.* Also the fruit here is valued at fifty cents per bushel, while the actual prices received for it varied from fifty cents to $1.25; and any increase in the appraisement of the fruit of course will proportionately increase the net gain. It is also to be noted that spraying and pruning produced no material effect on the *size* of the crop, since the treatment of all plots in these respects was uniform.

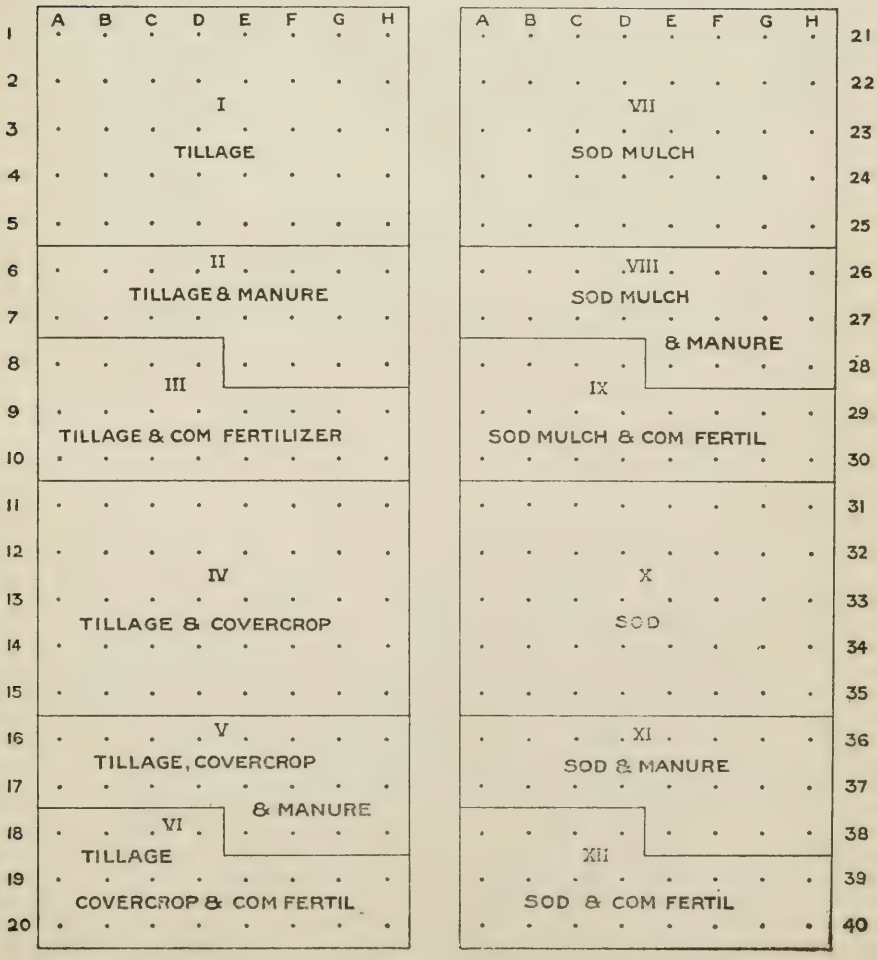
Such striking results as these of course are not to be expected everywhere. They evidently occurred here because plant food was the crop limiter in these orchards. For any given case this can only be determined by experiment. These orchards are on three diverse soil types. The soil in one case was evidently "run down;" in another case it was in average condition; and in the third it was apparently above the average. These orchards are from twenty-one to thirty-seven years of age and they are the only ones under experiment above twenty years. Age, however, is not a sure index

of the need of plant food, as one of our youngest orchards, a seven-year old, is responding strongly to fertilization, while some older ones have proved unresponsive. The big fact is that when such results as these are obtainable anywhere, it raises a strong suspicion that similar benefits may be obtained in many other orchards. And these results show beyond preadventure that in some orchards, apple trees, like other plants, respond strongly and directly to applications of plant food.

EXPERIMENTS ON CULTURAL METHODS

Closely associated with the question of plant-food, is that of soil moisture. It is undoubtedly the available moisture per individual fruit that determines in a large measure whether or not the apples shall attain their proper size; and it is largely to modify moisture supply that the various cultural methods are followed. The plan of our experiments comparing these methods is shown in Figure I.

Figure I



PLAN OF EXPERIMENT ON CULTURAL METHODS AND MANURES

As shown in the figure, this experiment tests four methods of soil management, viz., clean tillage, tillage and cover crops, sod mulch, and sod. Each treatment occurs both without fertilization and with it. The stable manure is applied annually at the rate of twelve tons per acre; and the commercial fertilizer at the rate of thirty pounds of nitrogen (N), sixty pounds phosphorus pentoxid (P_2O_5), and 100 pounds of potash (K_2O).

On the mulch plot all herbage remains in the orchard, the first cutting being raked to the trees as a mulch, and an additional mulch of old straw, swamp hay or buckwheat straw at the rate of about three tons per acre is applied annually. In this latter respect it differs from the so-called "Hitchings plan," and as a conserver of moisture it is undoubtedly very much better than that plan. On the sod plot, the first cutting of herbage is removed from the orchard and the second is left where it falls. The tillage plots are all cultivated until early in July, when those receiving the cover crop are seeded to crimson clover, hairy vetch or medium red clover and alsike, either singly or in combination. The results to date are from the unfertilized plots of the young orchards, and are shown in Table V. These results and those in later tables on young orchards have been obtained by combining the data from three orchards, whose age as noted in Table I ranges from seven to sixteen years.

TABLE VI

Effect of Cultural Methods on Yield, Color, Size and Growth, without Fertilization

Expts. 217, 218 and 219. Young Orchards. (a) Yield

1907-9.	I. Clean tillage.	IV. Tillage and cover crop.	VII. Sod mulch.	X. Sod.
Totals, 3 yr.,	15,048 lb.	16,057 lb.	17,776 lb.	13,880 lb.
Ratios,	108.	115.7	128.1	100
	100	106.7	118.1	----------
	----------	100	110.7	----------
1909. (b) Color. Per cent. Apples Colored One-half or More.				
Average per cent.,	75.4	81	81.5	85.6
Ratios,	100	107.4	108.1	113.5
1908-9. (c) Size. Average Weight of Apples.				
Average weight,	4.5 oz.	4.74 oz.	4.91 oz.	4.69 oz.
Ratios,	100	105.3	109	104.2
1907-9. (d) Growth. Increase in Trunk-girth.				
Average increase,	4.38 in.	4.14 in.	4.29 in.	3.58 in.
Ratios,	122.3	115.6	119.8	100
	----------	100	103.6	----------

In these results, the mulch system is first in yield and size of apples, second to sod on color, and second to clean tillage by a slight margin or growth.* It has surpassed the cover crop method on every phase and in total ranking is plainly first thus far in the combined results of this group of experiments. Reserving judgment on the relative merits of these systems for the present we may turn to consider the data from a similar experiment in an older orchard—that of Mr. Fassett, in which the trees are now thirty-seven years old. The results from the unfertilized plots in this orchard are shown in Table VII.

*The margin is really slighter than appears in the table, as the 1909 measurements in the mulch plot of experiment 218 were taken a little higher on the trunks than those of 1907, owing to the presence of screen on the trees at the later date.

TABLE VII

Effect of Cultural Methods on Yield, Color, Size and Growth, without Fertilization

Expt. 221, Mature Orchard. (a) Yield

1907-9.	IV. Tillage and cover crop.	VII. Sod mulch.
Totals, 3 yr.,	34,269 lb.	23,294 lb.
Ratios,	147.1	100
1908-9. (b) Color, Per Cent. appres Colored One-Half or More.		
Ave. per cent. of color,	57.4 %	87.5 %
Ratios,	100	152.4
1908-9. (c) Size, Average Weight of Apples.		
Average weight,	4.75 oz.	5.04 oz.
Ratios,	100	106.1
1907-9. (d) Growth, Increase in Trunk-girth.		
Average increase,	2.9 in.	1.32 in.
Ratios,	219.7	100

In the above results it will be noted that in the mature orchard, tillage and cover crop for three years has been far superior to sod mulch in yield and growth, having borne nearly one and a half times as much fruit and showing more than double the increase in growth. In color, the mulched fruit excells by more than thirty per cent;* and in average size of apples it excells by about six per cent. This last fact is undoubtedly connected with the smaller crop on the mulched trees.

The results of Tables VI and VII are apparently contradictory. They are all explainable, however, on the bases of soil moisture and age of trees. In the young orchards, with the herbage and three-ton addition of straw, an effective mulch of sufficient extent was maintained, while in the old orchard we were unable thus to cover more than probably half the root area. In the latter case the term *sod* mulch was distinctly appropriate since at least the outer half of the roots was under a typical sod and often in dust-dry condition.

*Really the mulch excels in color by 52.4 per cent., using the amount of color on the cover crop area as a base.

The results in Table VI indicate that, even in trying seasons such as the last two have been, the moisture in orchard soils may be conserved at least as effectively by a good mulch as by tillage. This conclusion is corroborated by moisture determinations made by Shutt, of Ottawa, Canada, in 1905 and 1906.† He also has found that leguminous plants, particularly those of dense and matted growth like hairy vetch, are much less severe in their drain on soil moisture than the grasses; and that the shade of the growing vetch is a better conserver than the mulch formed by cutting and leaving it in place. In other words, the loss by capillarity and surface evaporation from the practically bare ground was greater, under the conditions at Ottawa, than the transpiration through the legume.‡ The cover on our mature orchard is grass only, while on the young orchards a scattering growth of alsike or of medium red clover has been maintained in addition.

In further explanation of the difference in effectiveness of the mulch and cover-crop methods in Tables VI and VII, we may call attention to the hastening influence on bearing, which sod undoubtedly exerts under favorable conditions. This was shown in our results of last year,§ where sod on these same three orchards surpassed clean tillage in yield by thirteen per cent. It is also shown here later, especially in the sod-manure plot of Table IX. But the fact that this sod influence can be easily overdone and made to disappear under unfavorable conditions, is clearly shown in our results from the unfertilized sod plots of Table VI.

The next table shows the *effect of adding fertilizers* to the four cultural methods. All unfertilized plots are excluded from this table, and the yields given include both the manured and commercially fertilized plots under each method.

TABLE VIII

Influence of Cultural Methods on Yield, with Fertilization

Expts. 217, 218, 219. Young Orchards

	Two and three, clean tillage.	Five and six, tillage and covercrop.	Eight and nine, sod mulch.	Eleven and twelve, sod.
1908, yields,	9,193 lb.	9,512 lb.	11,203 lb.	10,351 lb.
1909 yields,	14,554	12,443	12,571	12,823
Totals,	23,747	21,955	23,774	23,174
Ratios,	108.2	100	108.3	105.6

Expt. 221, Mature Orchard

1908 yields,	----------	6,684	10,351	----------
1909 yields,	----------	28,297	22,545	----------
Totals,	----------	34,981	32,896	----------
Ratios,	----------	106.3	100	----------

†Central Experiment Farm. Report of the Chemist, p. 151, 1906.
‡Ibid, 1904, p. 158.
§Pa. Bul., 91:15, 1909.

As compared with Tables VII and VIII, these results show a marked leveling effect from addition of fertilizers. In other words, the applications of plant food have tended strongly to reduce or even nulify the differences due to cultural methods. This effect was also very distinct in the appearance of the trees in the field.

A consecutive increase in productiveness following the addition of plant food has been very marked in some cases. For example, the mulched plots of Experiment 221, receiving manure and commercial fertilizer, in 1907 produced 3,050 pounds of fruit; in 1908, as seen in the table, they produced 10,351 pounds; and in 1909, 22,545 pounds. And this occurred on plots receiving no tillage.

FERTILIZATION FOR DIFFERENT CULTURAL METHODS

The question often arises as to what is the best form of fertilizer to accompany different cultural methods. This question is partially answered by the data in Table X.

TABLE IX

Effect of Manures on Yield

Expts. 217, 218, 219

Season 1908-9 (2nd and 3rd Year).	Unfertilized.	Stable manure, 12 tons per acre.	Com. fertilizer, 30-60-100 lb. per acre.
Clean tillage,	13,698 lb.	21,605 lb.	23,022 lb.
Tillage and cover crop,	14,550	20,582	20,681
Sod mulch,	15,702	23,678	20,408
Sod,	11,706	24,772	17,929
Totals,	55,656	90,637	82,040
Ratios,	100	162.8	147.4
		110.5	100.

Expt. 221.

Tillage and cover crop,	33,119	31,924	35,502
Sod mulch,	21,091	35,396	28,370
Totals,	54,210	67,320	63,872
Ratios,	100	124.2	117.8
		105.4	100

This table shows the influence of fertilizers on yield when used in connection with different cultural methods. It will be observed that in every case except one, the yields from the fertilized plots have surpassed those from the unfertilized. And in the one exception the yields on the corresponding fertilized plots this past year were more than double the yield on it. In total effect, con-

sidering all treatments, the fertilized plots show a distinct increase over the unfertilized; and stable manure at the rates applied shows a small gain over chemicals.*

Examining the data still more closely, we see that in every case on the tilled plots commercial fertilizer has surpassed the manure, while on the untilled plots the reverse is true. In other words, the present data indicate that, from equal values of manure and of a proper commercial fertilizer the best results are obtained by using the manure on sod or mulch areas, and reserving the chemicals for use in connection with tillage. Either material, however, may be used satisfactorily and it is very probable that in any case a more or less regular alternation can be made more successful than either alone.

TABLE X

Effect of Manures on Color, Size and Growth

A. Expts. 217, 218 and 219. (a) Color. Per cent. Apples Colored One-half or More

	Unfertilized.	Stable manure.	Com. fertilizer.
Average per cent.,	71.2 %	61.9 %	62.4 %
Per cent. benefit,	----------	-9.3	-8.8
(b) Size. Average Weight of Apples.			
Average weight,	4.71 oz.	4.99 oz.	5.25 oz.
Ratios,	100	106	111.5
(c Growth. Increase in Trunk-girth.			
Average increase,	4.12 in.	4.3 in.	4.43 in.
Ratios,	100	104.1	107.5
	----------	100	103

B. Expt. 221. 1908-9. (a) Color. Per cent. Apples Colored One-half or More.

Average per cent.,	72.5 %	68.1 %	73.5 %
Per cent. benefit,	----------	-4.4	1.
(b) Size. Average Weight of Apples.			
Average weight,	4.89 oz.	5.42 oz.	5.33 oz.
Ratios,	100	110.8	109.
(c) Growth. Average Increase in Trunk-girth.			
Average increase,	4.22 in.	5.86 in.	4.92 in.
Ratios,	100	139	116.6
	----------	119.1	100

*More plant food is being furnished by the manure, since twelve tons of average stable manure are estimated to contain about 120 lb. each of nitrogen and potash (K_2O), and about 80 lb. of phosphoric pentoxid (P_2O_5). The relative cost per acre, as applied, is about $15 for the manure and $13 for the commercial fertilizer, outside of the cost of application.

Table X shows the effect of manures in both young and old orchards on color and size of fruit and on growth of trees. The effects have been fairly distinct in all cases,—reducing the color with one exception; and apparently increasing size of fruit and tree-growth.* In all cases, the color is least on the plots receiving stable manure. In the old orchard, manure shows some advantage over commercial fertilizer in wood growth and in size of apples, with effects reversed in the young orchards. The greater effect of commercial fertilizer in the young orchards is probably connected with the smaller area over which it is distributed, thus giving relatively stronger applications.

The above data are obtained from extensive work through a short period. In Table XI, we have data from the reverse conditions,—one experiment continued over twenty-one years.

TABLE XI

Massachusetts Experiment on Apples, 1889-1910 †

Treatments and Total Yields per Acre, to Date

Plot.	1	2	3	4	5
Annual Treatment.	Manure, 10 tons.	Wood ashes, 1 ton.	Check.	Bone & K Cl, 600 & 200.	Bone and low G. sulfate, 600 & 400.
Ave. girth,	38.25 in.	33.23 in.	27.98 in.	32.27 in.	37.02 in.
Ratios,	136.7	118.8	100	115.3	132.3
Yields, lb.,	24,934	12,841	3,910	14,453	21,863
Ratios,	632.8	325.9	100	366.8	554.9
Color and size,	4	1	5	3	2

These results are similar to those recorded in the preceding tables with the differences in some cases even more distinct. In every respect the treated plots have proved superior to the untreated. The manure plot, which alone receives nitrogen in quantity, leads in yield and growth but falls next to the check in quality. It is closely followed in yield and growth and much surpassed in quality by Plot 5, which received ground bone and low grade sulfate of potash. The superiority of 5 over 4 which differs only in the carrier of the potash is very interesting. Whether it is due to the magnesia in the sulfate or to a harmful effect of the chlorine ac-

*We say "apparently" increased the size of fruit, since the matter of size is undoubtedly primarily dependent on soil moisture and number of fruits on the tree. Thus any fertilizer effect must necessarily be indirect, as in the case of color.

†Data furnished by Director Wm. P. Brooks, of the Mass. Exp. Station, December, 1909.

cumulating from the muriate, or to a soil difference, cannot yet be stated. It will be recalled that our results of the third year corroborate it, in plots which compare only sulfate and muriate.

The practical point, however, is that with such differences as these existing even the over cost is small, and if so desired it can be readily met by a reduction in the amount applied. This would be justified by our present results, which indicate that the usual recommendations of potash for orchard use may be reduced to advantage.

CONCLUSION

In general, the whole question of orchard fertilization may now be regarded as dependent on the limiting factor or need. The productiveness of an orchard depends not on one but on a *number* of factors, among which are location, varieties, spraying, and other care. These factors are all bound together so that improvement in one may at times indirectly benefit the whole, yet in the long run it is the weakest factors that control the crop and through them only that it can be materially affected. This means that the usefulness of a fertilizer depends entirely on the need. Fertilization is profitable, where plant food is the limiter. But where something else is the first need and therefore is doing the limiting, it must evidently be brought up before fertilization can have any material effect.

In the same way, it is evident that it is useless to apply potash alone where nitrogen or phosphates are required. And it is also probably less effective to apply any transient or quickly available fertilizer much in advance of its most active seasonal need.

The problem before the orchardist therefore is one of determining limiters, raising them to the level of the other factors, and thereafter maintaining a balanced treatment of the whole. The determination of limiters is easy in most cases; but with plant food and cultural or moisture requirements it is done with certainty only by trial.

PROFITABLE BREEDING AND FEEDING OF BEEF CATTLE

By O. E. BRADFUTE, *Xenia, Ohio*

I possibly run some chance of duplicating what I may have stated at Harrisburg a couple of years ago with reference to beef cattle. However, I would rather duplicate than fall into the error of telling a different story. The one who has been successful along any line is hardly able to tell a very different story in regard to that success. So if any of you were present at Harrisburg when I spoke there and hear much of the same thing, you will have to content yourself with hearing the same experience twice.

I talk to you with reference to the profitable breeding and feeding of beef cattle. Beef cattle have not been prominent in Pennsylvania. As you well know the tendency of beef production has been westward continuously for a large number of years. But as the West has filled up and the large ranges have been cut up into farms it is becoming a question more of farming in the West. The tendency of the beef cattle production is again eastward because the process of making beef in the West is becoming more and more expensive. Eastern farmers were driven out of the business largely because it was not profitable. The matter was so much more simple in the West and the expense was so important an item that it made it almost impossible for eastern breeders to compete against the western breeders of beef cattle. I am not altogether sure that we have yet arrived at the period when we can say that the breeding grounds for beef cattle can be moved to the East. I may simply say that the tendency is again eastward; and this is very natural because the people who eat the best beef are the eastern people. There are no people so well located for the market of the people who eat the best beef as the people of Ohio and Pennsylvania. I understand very well that Pennsylvania has large dairy interests, and naturally so, because a good many people who consume these things are here in the State, therefore it is necessary for you to produce those things which pertain to the dairy. And so, the breeders throughout Pennsylvania are, of course, more conversant and have made quite a study of the problem of dairy feeding and breeding.

The problem of breeding beef cattle and the feeding of beef cattle is not different particularly from that of the breeding and feeding of dairy cattle. You will find, I think, that it will require the same amount and the same character of brains to make a success in the one that it will in the other. If any man thinks that he can successfully produce beef cattle in a haphazzard, easy way, without any expense and without any effort, I plead with him not to undertake it and expect to be successful. There is nothing that is worth attaining that comes without great effort.

As it occurs to me, the problem you will have to deal with more than any other, is the character of the cattle that you are going to breed and feed. The people to whom you will sell demand the best. They are not satisfied with ordinary beef. They can afford to buy the best. They have the money with which to pay for it and it becomes the business of the farmer to satisfy that demand. That demand is not one which is decreasing, but one which is increasing. Now when you stop for a moment and think you realize that everybody in this country wants to eat loin stake and the choice cuts of the beef animal. Nobody seems to be content with the flank steaks and with the inferior parts of the beef animal. Permit me to say that that is one of the things that enters into the high cost of living—that everybody wants to eat the superior parts of the animal. Now we have this with which to contend: about two-thirds of the value of an animal, as it hangs in the butcher shop, is contained in a little over one-fourth of that carcass; about sixty-four per cent. of the value of that animal is contained in about twenty-eight per cent. of that carcass. Now, I don't think that I need say very much more to convince you of the high importance

of having animals that have large proportions of these particular cuts, of the high priced selling cuts, because these are the parts that are wanted by the people, and it seems that everybody is willing to pay for that kind. Now if we intend to breed beef cattle, it is therefore important that we select a type of animal that will produce in the greatest abundance those particular cuts of beef. I am not here to plead in behalf of any particular breed of cattle. There are a number of breeds anyone of which will give you success along that line. I need only to name at least three of them,—the Shorthorn, the Hereford and the Aberdeen-Angus. That it is possible to make as great a gain on perhaps some of the steers of the dairy breed as it is on the steers of the beef breed,—I am not going to contend that it is not. There are men who have made a good profit feeding inferior cattle, buying in low condition, at a low price, feeding them up to a good stage and selling them at a considerable advance over the price they cost. That is a profitable method. But that side of it does not particularly appeal to me. I am one of those who look not only to reaping a profit out of a thing, a financial profit, but the profit of satisfaction as well. The profit of having said that you have done a thing well; that you are producing the best that can be produced, if you please; profit that comes from having produced a top notcher. I am not saying that profits are not made from inferior steers or animals, but I do contend that there is not only a financial profit but other profits as well that come to the men who are breeding better steers and that cater to the better markets in our great cities and to the better class of people.

Now, I am well aware that perhaps not many in Pennsylvania have the foundation cow, from which they can grow this class of cattle. There are some,—I know some splendid breeders of beef cattle in Pennsylvania. You have not the number that you had years ago when Washington county was prominent in this beef breeding. You don't so often hear of some community in Pennsylvania taking high rank as they did sixty years ago. When I was a boy I was always taught that one of the headquarters of pure bred stock of several kinds was in one of the counties in this State, Washington and one or two others. Of course, you have your great feeding grounds, particularly in the eastern part of the State where some very fine cattle are very profitably feed. But the problem will come, perhaps, in building up a herd of beef cattle with the foundation which you have. Now I want, in as far as possible during this talk, to confine myself to the simpler things along cattle lines, not the complex but simple problem that will come up constantly before you and the first proposition is getting your herd established, your beef cattle herd. How shall you do that? Perhaps you have practically no cows of a proper beef formation. Your neighborhood practically has no cows that are the proper type upon which to build a beef foundation. Can you afford to sell the cows which you have and go to the West and bring in cattle more of the beef type and start your herd along that line. That is a question which every farmer will have to answer largely for himself and under his own conditions. He knows what he has if he knows beef cows.

Now I am going to say this to you,—there are many of you older than I,—but it has been the surprise of my life to see men that have

been breeding cattle all their lives who are not able to distinguish why one steer is particularly better than another. A number of years ago an old gentleman in my own neighborhood, a very intimate friend of mine, had a bunch of very good steers and we were feeding a bunch of steers. A buyer came along, and offered us a cent a pound more than he would offer him. The old gentleman came to my house and looked over the cattle and said he could not see why that man would give us a cent more than him. He said, "Mine look just as good as yours and as fat." Probably they did. He had not learned to distinguish the type that the markets demand. And so I say to you that if you are going to start in the beef cattle business, one of the first things you will have to do is to get the type clearly fixed in your mind, just as the man who takes a block of marble to cut out a figure has the ideal in his mind all the time. He has seen in the block of marble just what it is to be like when finished. And so the man must see in the animal which he is going to form into beef just what character of animal this is going to be when finished, and when finished it must be of the type that is in demand, that the people want. Now I know of no better way, if you are not familiar with this type, than to go to the great shows in this country, such as State Fairs and great Beef Shows and study those types. I am not going to say that we are not in danger of overdoing it in following along the lines of certain types. There are men breeding dairy cattle who are perhaps paying more attention to the type of the animal than to performance, but with beef cattle the finished animal or what he is going to produce in beef, and therefore the type has very much to do with the character of the animal; so that you will have to have some means to learn the desirable type of the beef animal and then when you have once found out you will have to stick to it. There are so many men all over this country that put one so much in mind of the dog chasing the rabbit down a lane. Just about the time the dog gets hold of the rabbit he slips through the fence and the dog has to go to the trouble of jumping over in order to follow the rabbit, and just as he again about catches him, again through the fence he goes. Now there are many men in our country that are playing that same game with beef and dairy cattle. Just about the time they get a good herd of dairy cows and things are beginning to do pretty well, the bottom has dropped out of their market and it looks from the other side as if beef is more profitable and so he misses his rabbit. He jumps over the fence into the beef column and he starts for beef for a while, and when he gets his herd up to the beef standard he finds the beef is not worth very much. Butter is worth thirty to forty cents and beef only $3.00, and he tries to jump over the fence again, and thus he spends his entire life doing that thing. This country is full of men who have spent their lives doing that thing.

Now life is too short to jump over that fence too often. We cannot afford to do it. Then we have people that have tried to get over the fence by the dairy bull or beef bull. That is one way of getting over the fence if you undertake to do it. I can ruin the best dairy herd in the land in less than two crosses with a beef animal. I can do it with one cross; I can ruin the best beef herd in the land with one cross of the dairy bull. With about three crosses you can

get into fairly good results but not the best. Now someone will say, why not select a general purpose animal, so when beef is high you can make beef and when dairy is high you can make butter. Well, you can. Many men do do that but I do not recall one who is making a distinct success in either line by doing it. We find men content with small things, with the ordinary things. You have an ordinary animal. You produce only an ordinary amount of butter and only an ordinary quality of beef, but I believe that what is worth doing at all is worth doing well. If I want to grow beef I want to do that, but if I want to make butter I want to make butter. When I think of the general purpose cow—I cannot help but think of two ladders set up in the form of a "V." I once saw a trick performer have a little dog put his hind feet on the rung of one ladder and front feet on the rung of the other ladder and thus work up to the top of the ladder, but they don't do that way in the cattle line. They are set up in the form of a "V" and not an animal has been produced that can put its hind feet on the top rung of the one and the front feet on the top rung of the other ladder. When he gets half way he has reached his limit. And that is the way with the general purpose cow. We get half way up the ladder. If content with being half way up the ladder perhaps that is the cow for you to raise. But I do not believe there is a young man in the country who ought to be content with getting half way up any ladder. This is the age of young men and the young man who is going to succeed must stick to one thing. We cannot make great success and reach prominence in a few years. In many things it takes more than one generation to accomplish satisfactory results, and so I say if you are going into beef cattle go into it as if you mean to stay in it. Of course, if you do not succeed, you can sell out and commence anew in your dairy line if you wish, but don't try crossing back and forth and expect to reach success.

Now if you have a class of fairly good beef cows, by purchasing a bull, one with prepotent tendency, especially productive in beef, you might succeed in three generations of cattle life in producing a fair class of beef cattle. I am not here advocating generally the use of pure bred animals for the making of this beef nor of extremely high priced animals. I do contend that the man who is content with any sort of a bull which he may pick up, without knowing anything of his antecedents, and undertake to build up his herd on that foundation, will probably fail. It will interest you to know that we at our place have been able to sell time and again to men who have not a single pure blooded animal on their farm but simply grading up their herds to a good beef type, numbers of bulls for $200 to $300 apiece. Many men come to our place and say, "I cannot afford to buy a high class bull. I am not breeding pure bred stock." I am not so sure about that. The men who have topped the markets year after year in Chicago are not using $50 bulls; and the men who are topping the records along dairy lines are not using inferior bulls. If you are going to succeed with either you will have to have sires that will do what you want them to do, produce the type you want to produce, that are prepotent along their lines. And so I say if you have cows of a fairly good beef type, by buying a bull of that sort and placing in your herd you may be able to produce high class of beef cattle. The cattle which have won

year after year in Chicago at the great show (car load lots), have not been pure blood cattle, only a few groups in them have been pure blood; largely they have been high grade cattle, very often the crossing of two different breeds, particularly with reference to the Shorthorns and Angus, the crossing of the one with the other. We have all looked as if they belonged to the one breed and were not a few crossings of the two breeds. And so I say, breed to a good sire to get a good foundation. Select a sire of a particular type, or that character of animal, and then build up your herd with that foundation and go on to success.

Now I think we might turn our attention to the handling of our herd along beef lines. There are many who are discontented with dairy cattle on account of the labor required. It is that constant every day work that never lets up, seven days in the week, morning, noon and night. These cows must be attended to. The man who does that must be there all the time. I don't want you to feel for a moment that if you are to succeed in beef cattle that you can do so and not give it personal attention. It will require personal attention just as the dairy requires to make it a success on the part of the same competent man. But the attention is not so intense because following up the line which I have mapped out briefly, there are seasons when we have but little work to do with them. For the next three or four months the man who is in the beef cattle business, through the grazing period, will find himself able to take considerable rest while he can see the results going on. He does not have to be there morning and night as promptly as the cow is. And therefore many men are preferring to take up the beef industry simply because there is more of a rest connected with the beef industry than with the dairy industry. He has his rest days and lax months which seem never to come in the dairy business.

It is desirable, if possible, in beef cattle if you are going to breed your own calves, to have them born as nearly as possible at the same period of the year in order that you may have them all about the same age and the same size. It is just as easy to handle ten, fifteen or twenty calves as it is to tend to two or three, and if you have them all together it is a very simple matter to feed, just as with dairy calves. On the other hand if you want to keep some cows for milking, it makes a flood and then again you are without it. You will find that objection. If you are not going to use any of the milk it will pay you to have one or two dairy cows that you use for your family dairy and you have them the year through. I am going to advocate as largely as possible to let these little fellows nurse their dams. I have seen fairly good calves raised by hand and some fed with separator milk but never as good ones as with the other process. It is more expensive to raise them with their mothers. Indeed you have to figure closely if you can figure out how to keep a cow a year to grow a calf; but all that you shall have to find out in the growing of beef just as in the dairy, that there are many little profits, little turns of business that cannot easily be put down on paper, that you cannot readily see. There are many things on your farm that may be consumed to advantage by your beef cattle and hogs. So I say I think the better calves are produced by letting them run with their dams, and if you have good cows many will raise two calves. I have known of farmers in the pure blood

business who, instead of having two calves to one cow, have two cows for one calf. That is not profitable beef production. That is feeding to win. That is feeding for the show and it is necessary to do it that way if you are going to win, but those animals, individual animals, are not been fed at a profit. They are fed to win.

Begin to feed your calves as soon as possible. Within fourteen days after they are born you can give them a little grain. Now every day a calf lives in which it does not make a gain it is so much loss. As Mr. Kerrick, of Illinois, would say, you grow beef; don't fatten beef, but grow beef. Start with him as soon as born and make him into a beef animal. Make every day count. With the beef animal brought up until 1,500 pounds, the first 500 pounds of that animal is the cheapest, the second 500 pounds the next cheapest in production and the third 500 pounds you need to be careful if you do it at a profit; so then make your animal early. The animal is practically made the first twelve months of its age. Begin right there and push, push him along. Never let him rest from his labors. Calves over fourteen days old we begin to feed shelled corn. Sprinkle a little corn in a low trough and step out of the pen and you will be astonished to see how soon they learn to eat that corn. Almost immediately one calf goes up and makes a beginning and the others follow. Just a little the first feed, feed him scantily.

After a little while we add a few oats. I don't know that you can grow corn and oats on your farms to success. I am not going to lay down hard and fast lines that you have to follow because I have long ago learned that when you undertake to apply fixed rules to any line of agriculture you are up against something and you don't know what is going to happen. You say a thing cannot be done and about ten minutes afterwards a fellow gets up and says he did it. I am not going to say you cannot feed this or that because I am likely to find the man who says he did it. I am simply giving you our experience in doing these things. If you find that you cannot get these kinds of feeds, your experience along dairy lines teaches you that you can use other kinds of feeds for the feeding of dairy cattle is not different from the feeding of beef cattle. You will have to exercise your own judgment as to whether or not they are balanced. You will have to figure those things out with what you can produce upon your own farms and so we cannot lay down hard and fast rules. I believe the farmer, as a rule, who makes the most profit is the man who feeds the produce of his own farm, or exchanges that produce for some of equal or more value, but every exchange or move you make adds to the expense. In all your work with beef cattle, remember that simplicity should be the rule. Whenever you begin to dabble in complicated methods, complicated feeds, you are getting an expensive thing on your hands. The method I am going to advocate is simple and perhaps unfashionable on the part of many men, but it has been satisfactory and profitable with us.

I like to keep the calves away from the flies if I can. Flies have become a serious problem with beef feeders just as with dairying. The experiment station men will do a great thing for this country when they show how to get rid of the flies. They will add dollars to the beef and dairy interests of this country when they solve that

problem. It will pay to keep the calves where the flies don't disturb them, a darkened shed during the day time and then they can graze during the night or days when not disturbed.

We like to have our calves come in the Fall rather than in the Spring. By having them in the Fall or early Winter and in the stable we have them under our eyes all the time and we see that they properly nurse their dams. We don't let the calves run with the cows. We put them to the cow and put them back. We feed him with his dam and put him away. Thus your cow has fixed habits of letting down her milk, and if you care to milk that cow in after years she has that fixed habit; whereas, a cow running in the field with her calf is practically destroyed as a milk cow if you want to use her afterwards for that purpose; and then we constantly see the calves and know what they are doing. We begin with shelled corn and later add a little oats and then bran and then some oil meal, if we can get it, and good hay and good fodder.

Just a word about balanced rations. There is one thing about feeding beef cattle. In most cases they are fed to the full. If you put the feed where they can get it they will balance the ration for you. I am not going to advocate hard and fast rules along that line. It may be unfashionable, it may not be scientific, but I have noticed this in feeding our show cattle, if we want to get the highest finish and highest results and greatest weight at the earliest age, that we scarcely feed two of them alike. Those who have large families and help the plates of the children, even if the children are all well, will recognize that you can hardly make up two plates alike. If you make them all alike there will always be some dissatisfaction. A man who knows his children knows he need not put certain articles on all the plates. With stock it is just the same; some want one thing and some another.

By having the calves come in the Fall, when grass comes they are just old enough to wean, and then you don't ever have any bawling around. After you put them out for a few days it is all over. Another reason I like the Fall calf is this: That the first five or six months of his age, when he is quite small, he has consumed very little of your grain. He goes on grass when he is of the age to begin the consumption of feed and he eats the cheapest feed you have on your farm, so the second six months of his age, when he begins to work and consume something he is consuming your cheapest product rather than otherwise. If you have him born in the Spring he runs with his mother all the Summer, too little to eat much grass, and at weaning time he comes on your expensive feed, corn and grain. But if you are going to have Fall calves this necessitates a warm place for feeding and housing.

Now in regard to the sheltering of beef cattle: There is no class that requires so simple shelter as beef cattle. Any old shed that opens to the south and a protection from the west winds and rain is satisfactory to these cattle after a year old or even after they are six months old. I don't care anything about the cold, if they are dry and out of the wind. They take care of the cold if well fed and make as good gain with good feed in the open sheds. If you are going to feed in an expensive manner, under high tension, or if with silage to your beef cattle, then I think you will have to have them more closely housed and it is then a problem that each man will have to work out on his own farm.

I am going to give you a simple method by which you can feed cattle that will at least give you profitable results and I know it is a success, one of the simplest methods and in fact so old fashioned that I hardly dare name it; that is, the old fashioned method of feeding shocked corn and clover hay. Feed it in the open racks, open sheds, in the simplest manner. If you can get your corn well cut and well put up, and your land is such that you dare go out on it in the winter months with the wagon and get the feed, it is the simplest, and I believe, one of the most profitable methods that can be used. Let me show you the difference between that and the other method. Suppose you determine to feed in a complicated method and use silage and ground feed in connection with that. It first involves the silo; it next involves a good warm barn; it next involves the husking, shelling and grinding of the corn which you don't put in the silage, for the finishing period. It involves feeding in the inside which is always more laborious than feeding in the open racks. It takes more time and you have added almost one-third to the cost of the feed by the time you get it into the cattle, but you have not added a third to its feeding value. You have added slightly but not one-third. If you have a silo convenient or can get it at a reasonable price, if you have the power and the grinding equipments and shelling equipments, well and good, but this thing can be done with the simpler method and with as great profit to the farmer as he will find the other way. Several times we have topped both the Pittsburg and Chicago markets with carload lots of cattle, handled as I have told in the simple ordinary old fashioned way, therefore, I know it can be successfully and profitably done. The cost of the more complicated way forced many men out of the business. I said to you that the cattle-growing business was drifting back East. I want to give you one of the reasons for that—because of the great expense of growing beef in the West to what it once was. In much of Texas the method has been to feed cottonseed meal. Texas is the greatest cattle-producing state in the Union, and has more cattle interests than half the other states put together. In 1880 the cost of feeding a steer, finishing on cottonseed meal, was $6.00 to $7.00 per head. In 1890 it had risen to $11.25 per head; in 1900 to $17.50 per head, and in 1910 the cost of feeding cottonseed meal in Texas will be from $25.00 to $27.00 per hundred. Now you can see that Texas is getting itself in the position where you can begin to compete. When they were finishing steers at from $6.00 to $7.00 per head on cottonseed meal and it was costing you $20.00 to $30.00 on corn, you can see that you could not do it. But now they have gotten to the point where cottonseed meal is costing from $25.00 to $27.00 per head to make their steers and you can meet with that competition; and this is true through nearly all the West. The advanced cost of producing their beef has become so great that the drift is again eastward, and profitable beef production can be undertaken in the East.

The question comes up as to how far to carry the steer, whether to make baby beef of him or sell at the later age, and let me give you some figures again. For a period of five years the average 1,500 pound steer in Chicago was bringing $6.03 per hundred; the average 900 pound steer was bringing $4.40, a difference of $1.63; and the total gain there per hundred as between the 900 pound and 1,500

pound steer of twenty-seven and one-third cents. Let me take you over a fifteen year period in Chicago, all of the cattle of all kinds that went over the scales in fifteen years. The 1,500 pounds steer averaged $5.51 per hundred while the 900 pounds steer averaged $4.25, a difference of $1.26 or a total gain of twenty-one cents per hundred pounds. Now you can see there is a fixed rule by which the heavier cattle, the more finished and heavier, make a good gain in price per hundred pounds, and so it will be up to you to determine when you want to let go of your cattle. If you carry them to the finished period you may depend on a good price and a fair profit.

I don't know that I have covered this subject, but I believe in the success of beef cattle, that they can be profitably produced, not only in Ohio, but I believe they can be profitably produced in Pennsylvania. And I want to say this to the young men who are present:

"And I have said and I say it ever,
As the years go on and the world goes over,
'Twere better to be content and clever
In the tending of cattle and the tossing of clover,
In the grazing of cattle and the growing of grain,
Than a strong man striving for fame or gain."

BEEF CATTLE—THEIR RELATION TO PENNSYLVANIA AGRICULTURE

By PROF. W. A. COCHEL, *State College, Pa.*

The function of Beef Cattle in Pennsylvania, as in all other states, is to convert the crops grown on the farm into a more concentrated and palatable product for human consumption. In great areas of the West beef cattle are used as a means of marketing grass which would otherwise have no value. Coming farther East they are used in the corn-belt to market surplus corn and clover. As the preceding speaker has clearly pointed out, they must be handled with a minimum amount of labor if they prove profitable. In our own State we should first consider the feeds which we have at our disposal, of which grass constitutes by far the larger part. In addition, we have an abundance of roughage in the form of clover, mixed hay, cornstalks and straw. Grain is not produced in so large proportion as roughage, hence we should try to produce such beef as can be made largely on rough feeds with a minimum amount of grain. Fortunately the local demand does not call for the thick, heavily fattened animals which can only be produced from a long period of full feeding on concentrated feeds, but for "good killers" and "butcher stuff" which would require from sixty to ninety days feeding to make them "prime." These two factors fit very nicely together and indicate that the Pennsylvania feeder is fortunate in

having a demand for the kind of beef most easily produced with the feed at his disposal.

Your College of Agriculture and Experiment Station has undertaken a study of a few of the factors which have a direct bearing on profitable methods of fattening steers. For this purpose two carloads of "feeders" were purchases on the Chicago market at $4.65 per cwt., December 1, 1909. They were shipped to State College and allowed two weeks to overcome soreness from shipping and to become accustomed to new conditions before the Winter's feeding experiment was started. Charging the cattle with commission, yardage and freight enroute, also for all feeds consumed before the beginning of the Experiment, made them cost at that time five (5) dollars, per cwt. They averaged eight hundred pounds per head in weight. They were fed in four different lots during a period of five months, at the close of which they were valued by Mr. J. K. Conrad, of Pittsburg, using the Pittsburg market value as a basis for computing financial results.

Lot I was fed a full feed of grain, with roughage limited to what they would clean up readily. Lot II was fed two-thirds as much grain as Lot I with all the roughage they would consume. It was found from this comparison that the steers fed a full feed of grain made more rapid gains and would have had to sell for $6.68 per cwt., at the close of the experiment to pay for feeds consumed, while their market value at that time was $7.60 per cwt. The profit per steer was $9.96 which made the corn fed bring 97.1 cent per bushel. When a lighter grain ration was used the rate of gain was not quite so great, the cost of gains less and the cattle would have had to sell at $6.23 per cwt., while their actual value was $7.35 per cwt. The profit per steer was $11.80, making the corn fed bring $1.19 per bushel. The heavy feeding of grain during so long a period as five months was not justified by the additional finish carried by the full-fed cattle over those receiving a limited ration as the difference in cost was thirty-five cents and the difference in value only twenty-five cents per cwt. This experiment clearly demonstrates that the Pennsylvania feeder, using high-priced corn, cannot afford to put steers in prime condition, as the local demand is usually for a cheaper grade of beef.

The second experiment was one to test the influence of shelter for fattening steers which have a roughage ration made up largely of corn silage. The cattle were quite uniform in age, type and condition. One lot was fed in an open shed, boarded up tightly on three sides, open to the southeast, the other lot in the basement of a bank barn, well lighted and well ventilated. Each lot was given the same amount of concentrates with roughage according to appetite. The results show that the steers fed in an open shed gained 2.36 pounds per head daily as compared with 2.13 pounds by those in the barn. At the close of the experiment the open-shed steers had cost seventeen cents less per cwt., were valued at fifteen cents per cwt. higher and made a profit of $3.98 per steer, more than those fed inside. The corn fed outside brought fifteen cents more per bushel than that fed inside. This test clearly demonstrates that the feeding of corn silage does not necessitate the use of warm quarters for fattening cattle. It is essential, however, that the steers be well-bedded and protected from wind and rain.

The work of the Station has clearly demonstrated that, under the conditions prevailing during the past winter (1909-10), beef cattle bought upon the open market, fed intelligently, have paid market price for all the roughage consumed in addition to one (1) dollar per bushel, for the corn. This does not include the value of the manure nor the amount of waste feed utilized by hogs. While the price of beef was exceptionally high during the past year, the same was true of "feeders" and of feeds, so that the results are not abnormal.

In closing, I might say that the function of Beef Cattle in Pennsylvania is to utilize large amounts of roughage, to enable the farmer to carry a large amount of livestock in proportion to the labor required, to turn to profitable account large areas of rough grazing land that is at present not under cultivation, to furnish a market for the damaged and unmarketable material produced on practically every farm and at the same time build up the soil in order that it may continue to produce maximum crops. If the farmer will go into the production of beef in a conservative way, selecting cattle of the proper type, he will undoubtedly, in a series of years, be in much better financial condition than one who markets his crops in their original state.

ADDRESS

By E. S. BAYARD, *Pittsburg, Pa.*

You know what I told last year, you can't keep a good man from "coming out at the top."

I am very much interested in this discussion on beef cattle and I think that is the reason Mr. Black called upon me, because he is a beef cattle man and he wanted to prolong this discussion.

The CHAIRMAN: We don't want any other subject introduced.

MR. BAYARD: I will try to keep on this subject. There is one thing I want to emphasize and that is in regard to our markets in Pennsylvania. We have a peculiar market here in our coal and manufacturing towns. It requires ordinary or half-fat cattle. I have come to the conclusion that it will pay a man to buy in the fall common cattle, the kind he can buy cheap, and feed them for this market. When you come to breed cattle, breed the best you can. But the man who feeds cattle can profit by the other fellow's folly. The cheaper he buys them the better for him, because he can often make a greater improvement in value on the common steer than on the other kind, especially if he does not carry him to a finish. Take a common steer in the fall and when he has more flesh he goes up a notch in the market classification. These cattle, to be sold before they are fat, can use a cheaper class of fed than the good cattle. They lack breeding of course and when marketed make ordinary butcher cattle. They sell comparatively high because of the peculiarity of our market that does not require so much fat. The country

butcher pays a comparatively high price for the common steer. The butchers are paying now around $7.25 for pretty ordinary steers. It seems to me that Pennsylvania people should adapt themselves to the requirements of the meat market. They can buy this common stuff cheap in the fall and they can sell it comparatively high from the 1st of February on up to June or July. Of course if you have to ship your cattle where they require high-class beef I would not take that kind of cattle.

I often wonder if the people of the State understand much about the grades of cattle in the market. I remember a number of years ago a man came to Pittsburg with a load of steers that sold for less than our lowest quotations for common ones. He found out who I was and he gave me a call-down. He said he had good cattle and they sold below our lowest quotations. We went down and looked them over. I had never seen such cattle as he had. I didn't know cattle could be that common. They were little mouse-colored and brindled knot-heads. Those cattle were raised somewhere in the brush. They didn't have anything about them that good fat cattle ought to have. Yet he thought he had good cattle and thought he would get a good price for them. Now the market price does not depend upon what your idea of cattle is. It depends on what the killer's idea of cattle is, the man who cuts them up. It is his ideas and not yours or mine that count.

Would you like me to tell you something about the grades of livestock? In the first place for the past winter the market-topping steer has been one of some weight, smooth and fat, 1,350 to 1,450 pounds—they don't like them heavier than 1,450 pounds. This week a load of cattle sold at $8.70 that topped the market. They weighed 1,434 pounds and they were good. Next to that we have a class of cattle that have the weight and flesh but not quite as much quality. They have not the shape, not the breeding, possibly too much soup bone underneath, perhaps a little plain. Then we come to another grade that weigh around 1,200 to 1,250 pounds, good and fleshy but not quite heavy enough to bring the top, sometimes bringing more than the heavier type but not at present; those cattle are selling around $7.75. Then we have what we call good butcher steers, good fat butcher steers, 1,100 to 1,150 pounds. They must be well shaped and well bred and well finished, and you can get a steer that weight now of good finish. I saw several loads of cattle of that kind sold on Monday that I call good cattle, at $7.60 and $7.75. In the summer time they sell higher in proportion than the heavier cattle do, but you all understand why. Butchers cannot keep the heavier carcasses so well in the hot weather. Then we get beyond that and have the ordinary class of butcher cattle weighing 1,000 to 1,050 pounds. They sell around $7.25 now. And then we go below that to a rather common lot of butcher cattle, weighing 900 to 950 pounds and selling at $6.50 @ 6.75. When you go below that you get into the trashy class, $6.00 @ 6.25 the way the market is now.

Perhaps I would better say something about market bulls, cows and heifers. When I first went into the cattle business if you raised a heifer, no matter how good, you got no price for it; 3 @ 3½ cents for a good heifer. This has changed. To-day you can sell your fat heifers to the butcher markets all over our State and get a good price for them. I saw a load sell for $7.90 per cwt. the past winter and

they were not all heifers, a few cows among them. A good fat heifer weighs from 800 to 1,000 pounds as a rule, sometimes they weigh more, but that is the kind they like. I saw three averaging around 850 pounds sell the other day for $7.50 per cwt., good and fat. Cow buyers like them to weigh from 1,000 to 1,200 pounds. A really good young smooth cow is worth now around $6.50. If older and full of tallow they don't bring so much money, some of the older ones with more fat on them $5.50 @ 5.75.

Bulls sell well now. Any man who is a good feeder I would be willing to keep in bulls if he would give me his old ones when he is done with them. What excuse is there for not breeding good cattle under those terms? You take an old bull and you can sell him any time between the 1st of January and 1st of June for enough to replace him with a young one. I am talking about those bull calves you can buy for $75 to $125 to use on good grade herds. The breeder can sell you a yearling calf to take the place of your old bull for what you get on the market for your old one if you take care of him. Why are bulls so high? The pure food law has something to do with it, by forbidding the use of coloring matter in bologna. High-colored bull meat is used to get the color into the bologna. I have seen a few bulls sell this winter for $7.25, a whole lot a $6.75 @ 7.00 per cwt. It takes a pretty good steer to bring $8.00. What excuse is there for not having better cattle when we lose nothing on our bulls?

In regard to the hog market we have another thing in this State that is advantageous to the producer. It used to be we had to feed a hog a long time to get him heavy. You don't have to do that now. Yesterday light hogs sold at the top—$10 a hundred pounds. The hog does not have to be fed so long to get the money out of him. The hogs in the Pittsburg market are graded thus: Heavy hogs, anything of 250 pounds or over and sometimes of 225 pounds or over. Medium weights, hogs of 180 to 200 pounds. Heavy Yorkers, hogs of 160 to 175 pounds, and light Yorkers, 125 to 150 pounds. These hogs are called Yorkers because New York buyers used to take these weights while Philadelphia buyers took heavy hogs, which were then called Philadelphias. That name has passed away now, as Philadelphia takes light hogs too. Heavy hogs are still taken by Boston and Providence. Then we have pigs, 90 to 110 pounds, which along with light Yorkers now top the market. One year with another the heavy Yorker or medium-weight hog sells here as well or better than any other. Considering cost of production these lighter hogs make the feeder most money—the younger the hog the cheaper the gain. Another point where the market favors the producer. "Roughs" are fat sows and sell well. Stags are not docked in weight but in price.

A Member: Why did we run out of hogs?

MR. BAYARD: I think one reason we ran out of hogs is that two years ago the hogs sold below the cost of production and farmers did like all manufacturers do—quit producing them.

In the sheep market we used to have a big fat wether at the top. Now we are handicapped if we have heavy sheep. In Pittsburg they don't like a sheep of over 100 pounds. I believe we ought to

use the heavier cuts because they are more economical on the table, but the trade does not call for them. Butchers must have them light. And the same way with lambs. They don't want them over 80 or 85 pounds or they will be too heavy for the market. I ran across a peculiar thing in the Pittsburg markets Monday, in spring lambs, just to show you how little market things go. We have been advocating for years the docking of lambs, but now buyers want spring lambs with tails on. Why do the butchers kick about cutting off lambs' tails? The butchers say slaughterers are running in the yearling lambs for spring lambs and the only way to tell them is to leave the tail on. Of course, if he pays ten cents a pound for spring lamb he cannot compete with the man who pays seven cents for a little fall lamb or last spring's lamb. All these things and a whole lot more you will find out if you stay around the market some time.

I saw something the other day that utterly disgusted me. Some secretary of a dairy cattle association went on to show that dairy cattle were just as good for beef as any other cattle. We all know better. He will know better when he takes a load of them to market. I have seen them sell and I saw one time Brown Swiss cattle, not such a bad shape, but were discriminated against because of their color. A seller in Pittsburg one day called me into a pen of these to prove to the buyer that they were not Jerseys. The buyer would not buy them on account of color, which resembled Jerseys, and I had to tell him they were Brown Swiss and would not kill like Jerseys. The buyer knows what he is talking about, because he takes the animal and kills and cuts it up and he has got to make his money out of it, and that has not been so easy the last year.

Many people talk about the enormous profits the butchers are making. If you get into the butcher business you will find there is a great deal of waste in cutting up cattle and hogs and sheep, and everybody who buys meat in the State is doing his share towards the high cost. Instead of going down to the market and buying a chunk of meat we go to the telephone and order twenty-five cents worth of it and the butcher has to send a man and a horse and wagon up with it, and the delivery costs almost as much as the meat. Another thing: We will spend a lot of money for cigars and for other luxuries that don't do us any good, and when we add a cent to the price of a pound of meat or a quart of milk every man will rear and kick! And then he'll go and spend twenty-five cents for a cigar or buy half a dozen men drinks! We must educate the consumers too. They need it worse than we do. I have had experience on both sides.

Here is another matter. I talked with a man the other day who told me about the tariff on shoes. He said the market would be flooded with cheap English shoes because the tariff had been reduced. I said: Well, you knocked the tariff off the hides that I produce, why should not I knock the tariff off the shoes, the products of these hides? I am entitled to buy my shoes on the same basis that the manufacturer buys my hides. We farmers can't afford to sell our wool and hides on a free market and buy all our clothes and shoes on a protected market, and we are a lot of chumps if we allow it; but we are going to be asked to do that same thing.

I see it coming—all tariffs off farm products, and they are going to leave tariffs on everything we buy. We are a set of fools if we allow it. I don't want to be led into a tariff question, but I have to show your chairman there is something up here (indicating his head) inside, if there isn't very much outside.

PRACTICAL METHODS OF POTATO GROWING

By E. A. ROGERS, *Brunswick, Maine*

Mr. Chairman, Ladies and Brother Farmers of Pennsylvania: I esteem it an honor and a privilege to have this opportunity to come before you and talk on any agricultural subject, especially the one which I have made a personal study of since boyhood—the growing of potatoes. We, in the East, are on the threshhold of better times for the farmer. The last generation has seen eastern agriculture at its worst.

There are reasons for this which I sometimes think we overlook. If we go back a few years to the close of the Civil War when men of all nations were invited to come to this country, and were practically given free farms in the great fertile West, coming as they did by hundreds of thousands, taking up that fertile soil and coming into direct competition with the farmers of the East, the result was harmful to both the eastern and western farmers, as it forced the latter into a soil-robbing system of farming, not based on any scientific principles, and could not help but result in the depleted soils we now find in the West. At the same time the influx of agricultural products from these western farms crowded down prices here in the East so that there was but little, and in many cases, no profit left to the eastern farmer on his harder worked soils. The eastern farmer, after years of struggle to make both ends meet with the low prices prevailing, lost the high opinion of his calling he ought to have until it has become almost second nature with us farmers here in the East to cry down agriculture. This has forced our boys to leave the farm, especially through New England, and I presume that this is true also of Pennsylvania. Time is changing conditions; the western farmer, who for years sold fertility from his land in the form of grain, now finds his fields depleted of that fertility far beyond anything he believed possible, and he has now reached the same point that we here in the East have, that is, he has got to be a soil-builder instead of a soil-robber, and from now on the East and West stand on an equal footing as regards soil fertility.

This means a new era to the agriculture of the East; we can now talk to our boys of the money that can be made in farming and no longer tell them that if they ever expect to become well off they must

leave the farm. Why, it was drilled into me from the time I was knee high, that if I was going to make money I must get off the farm. This had a basis of truth twenty-five years ago here in the East, but it is not so to-day.

Then there are other things to consider worth more than mere money to those who stay on the farms. There can be and are good homes in the cities, but if there is any happy place in the world it is a good farm home. Did you ever know a millionare that was happy? Or did you ever know a man who was worth hundreds of thousands of dollars that was happy? If you want to find a happy man, woman or family go to some farm where they are making a comfortable living and a little to lay up besides. But when I was a boy they told the boys, "if you want to be rich you must leave the farm." They seemed to forget there were other things of greater value than gold and that one of them was a pure home out among the green trees where the birds sang and fruits could be had for the raising and no better homes can be found in God's world than we find on the farms of America to-day.

Another thing they told us when we were boys that has hurt eastern agriculture, and that was that our soil was worn out. We must get that idea right out of our heads. Here in the East we have no such thing as worn out soils. Our rock-formed soils will never be worn out, but will be producing better crops generations hence, under a more enlightened system of scientific farming than they have ever produced in the past. The chemist will tell you that in the first eight inches of clay loam soil that we have enough phosphoric acid to grow maximum crops from 150 to 200 years and potash enough in the same soil to grow maximum crops from 200 to 400 years, but locked up in an insoluble form, a wise provision of nature, to keep one generation from robbing posterity and prevented us from getting and selling it at the time our agriculture was depressed with western competition. In the second eight inches of soil there is as much more, and with scientific handling of our soils, we can make available from year to year enough to grow maximum crops, and we can go on indefinitely with no danger of robbing those who are to come after us.

What does our eastern soil need as much as anything? Vegetable matter. And of all crops, I think the potato demands it more than any other I know of if we are to have it do its best. If you give potatoes plenty of vegetable matter in the soil,—and I want to say that this is true of all soils in my section of Maine and I think it is true of you here, you can grow as good crops of potatoes as they can grow anywhere. The more vegetable matter you have in the soil the more water will it contain, and the better will the crop stand the drouth. And another thing, the decay of this vegetable matter acting upon the locked-up phosphoric acid and potash, will liberate and make some of it available for our growing crop and save us from buying so much of these kinds of plant foods in the form of commercial fertilizer. Now let us imagine we have an old field here, one that has not been plowed for years and the hay has been cut and hauled off and no return made to the soil. Also that we have no barn dressing which we can spare to apply to this particular field, and we want to get a crop of potatoes and at the same time fit it to produce a paying crop of grain and hay in years fol-

lowing. An old field of this kind will, in my section at least, have a fairly good turf; this means that there is a fair amount of vegetable material here to help grow a crop of potatoes if put in the right place and condition. I like to get on such a field in the late summer or fall preceding the planting of potatoes, with a cut-a-way harrow and cut up this turf to the depth of five or six inches; this work should cover a period of several weeks, working it enough to entirely kill out and cut up the sod. This will also bring to the surface where they will sprout, millions of weed seeds, making our labor the next year when the potatoes are growing much less.

With a good sod to start with it is not necessary with us to sow rye and vetch to plow down in the spring, and where this is not done the land is not plowed at all until the following spring. When spring arrives the ground is again harrowed as deeply as possible. We now have all the old sod worked up finely and ready to plow under and the deeper this can be done the better crop of potatoes we will get. On my soil I plow not less than eight inches, and nine will be nearer an average. We now have turned down this worked-up sod or vegetable matter into the bottom of our furrows and have it in the best possible place and condition, not only to feed the potato crop but to hold moisture, and at the same time it is not in such a condition as to prevent the subsoil moisture from coming to the surface by capillary attraction, as would have been the case had the sod been plowed down without first being worked up into this finely pulverized condition. After plowing, the harrow is again put on, and we now have the whole depth plowed a finely pulverized seed bed with the worked up sod thoroughly mixed through the bottom half of the depth plowed.

This is the way this field shown here in this photograph was worked. Up in Southern Maine last year we had a dry season, the dryest we have ever known. From the 17th of June until the 17th of August we did not get enough rain to lay the dust, and two months with us during our longest days is pretty hard usage. I got the field planted on the 19th of June and you see it did not get much water until after the middle of August. When I planted I used a half ton of fertilizer per acre in the drill. Of course we use the planters almost entirely in my State, and I presume it is the same with you. This fertilizer was a 4½-7 and 10 used on this field I am showing you in the photograph. The fertilizer I am using this year is a little better in some respects or a 4-8-10, this is about as strong as we can make with using the highest grade chemicals without any filler. As soon as the field was planted I went over it with the weeder and brushed the rows down level. This could have been equally as well done with a brush or smoothing harrow or even a properly constructed plank drag, but as often as weeds show the field should be gone over with either a weeder or light smoothing harrow. Usually, previous to leveling down the rows after planting, I go over with a two-horse double cultivator and cultivate as deeply as possible and as close up to the rows as it can be done without disturbing the seed. When the potatoes get to breaking ground enough to show the rows nicely, they are given the second cultivating and then we are ready to apply the second application of fertilizer.

Perhaps I did not state that we plan in the State of Maine, and almost universally now, to use one ton of high grade fertilizer to

the acre. Some of you may think this is excessive, but experience has proved to the Maine potato grower that it is economy to do so, as the increased amount of fertilizer over what we formerly used (12 to 15 hundred pounds per acre) will increase the yield of potatoes more than enough to pay for the extra amount of fertilizer, and leave that much larger amount in the soil for the grain and hay crops which are to follow. One ton of high grade fertilizer per acre will not only produce a large crop of potatoes running from three to over four hundred bushels per acre, and still leave in the soil with the liberated plant food which was originally there and made available by the cultivation of the potatoes, enough to grow a big crop of either corn or small grain and two years of magnificent hay crops. I am frequently asked why not apply all my fertilizer at one time and in the drill when planting. My experience is that ten to twelve hundred pounds in the drill along with the seed is all we can safely use without danger of the fertilizer burning or injuring the seed, and even this amount is not always safe on early potatoes, as usually they will not stand as strong fertilizer as will the later or more vigorous varieties.

More than this I believe I get a better crop by applying a part of it along the row after the potatoes break ground, and burying the fertilizer, weeds and potatoes all out of sight as you see I am doing in the photograph. From every leaf joint that is buried up there will immediately be sent out a new set of roots, and sometimes there will be three or four of these one above the other, according to the height of the potato stalks when buried; all these will be above this second application of fertilizer and makes the root system just that much greater, and the greater the root system the better will the plant stand drouth and the better will be the crop. I keep my cultivator teeth far enough apart so that I do not do any root pruning. I do not know how you do it here in Pennsylvania. I know they do it down in Jersey. They will take the potatoes up to one foot or more in height and cultivate them with the cultivator set to run so close that at the end of each row they can take a handful of the feeding roots of the potatoes off of each tooth. This is root pruning and is poor practice. I aim to increase the root system every time.

Now another word in regard to the fertilizer. I plan to have my nitrogen-content in two different formulas. The one used in the drill at time of planting not containing any nitrate of soda. Nitrate of soda will become available over night in a damp soil which we are most always sure to have at the planting season. As you all know, it is usually several weeks after planting before there is any root system to catch and use this available nitrogen from nitrate of soda and in case of a heavy rain right after planting much of it might be lost. It is better that the nitrogen-content of the fertilizer used in the drill along with the seed be in the form of tankage, dried blood and other forms not quite so quickly available as is nitrate of soda. In this way it is not likely to become available and be lost from the soil by rains before the plants will have formed a root system to utilize it. For the second application I will have the nitrogen-content made up of just about one-half nitrate of soda. As I do not apply this until the plants get a few inches high, there is a root system already formed to take it

up and it promotes a very rapid growth at this time which shading the ground helps to retard the growth of weeds and lessens the injury done by the flea beetle and other insects. If we are to bury our potatoes after they are up a few inches high we must have them come up good and strong. If they come up weak and spindly we cannot bury them deeply enough to kill all weeds without injury to the potatoes themselves but if they come up sturdy and strong we can cover them up several inches deep and they will immediately grow right up through from the centre. The large leaves that are buried do not come up and if there are any of the old potato beetles eggs on them they will never hatch. In the cutting of the seed we can do several things towards making a stockier plant. The roots of the eye run towards the stem end, hence we should cut above the eye in order not to cut off too short these eye roots, and cut in blocky pieces of good size.

SOME MODERN POULTRY PROBLEMS

By J. T. CAMPBELL, *Hartstown, Pa.*

The profits from the poultry industry are dependent on the ability of the fowl to live and to reproduce. Doubtless all our modern varieties of fowl are descendants of some wild species. In the wild state the fowl laid a few eggs and raised her brood, she had accomplished her purpose—reproduction. On this offspring, nature imposed many hardships so that only the most vigorous survived—began to again reproduce. Under demonstration with more favorable environments the weakling is enabled to survive and to reproduce. Not only this but the hen is enabled to produce several times as many eggs as in the wild state, as we shall later see, all calling for plenty of vitality to produce them.

Here then we have two principles involved, each working against the other. The call for greater vitality, greater ability to live and reproduce and the selection and breeding from birds often of low vigor. Hence we have eggs that do not hatch chix that die and many kindred trouble.

As long as we pay more attention to standard points than to constitutional vigor we may expect no improvement along these lines. It is of vastly more importance that the fowl have strong, straight legs set well apart, than that there be no down between the toes.

The short, stout, sharply curved beak and the short, thick head with the eyes prominent and set well back in the long cavity will avail much more than five points on the comb, when it comes to getting a profit out of our farmer flock. The farmer usually buys his breeding stock on the show records of the breeder, getting cheap stock he has neither show birds nor stock selected and bred along the practical lines.

Good, pure bred stock will pay a big profit over the mongrel, provided the pure bred stock are selected and bred for constitutional vigor more than for fancy points. At the West Virginia Experiment Station during four winter months a pen of good mongrels laid 364 eggs and a similar number of strong vigorous White Leghorns laid 1,029 eggs, both pens getting the same care and feed. Some instances are on record where the mongrels have outlaid the pure breds. This can easily be the case when the mongrels have plenty of vitality and the pure breds are the weakly kind often found in the small yards of the fancier.

The advertising of breed to lay, trapnested fowls has deceived many. There is not one particle of evidence as far as I have been able to find to show that the egg laying capacity of the race can be increased by breeding from the heaviest layers as indicated by the trapnest. In fact the evidence as far as I can learn is on the reverse side. In my own experience I would rather have hens raised from stock of moderate producers than from the heaviest producers. I get more vitality in this way. Nature seems to put limitations on some of these things. That there may be a degree of protection to the vigor of the race, we often see excessive fecundity accompanied by partial sterility.

In fact I am inclined to think that the limit has been reached in the number of eggs the hen can be made to produce as far as breeding has to do with the matter. The records show that hens, under favorable conditions laid as many eggs one hundred years ago as now. On this point see Experiment Station Record, page 279, Sept., 1909. The most careful breeding by skillful scientists has failed to increase the average production of the race. It is one thing to call out the poor layers, and quite another thing to raise the average of the race by selective breeding.

On this point I quote Dr. Pearl, of the Maine Experiment Station: "The data so far obtained do not indicate that egg producing ability is sensibly or directly increased between mother and daughter. The mean egg production of the daughters of the 200 egg hens, is with a single exception smaller than the egg production of the birds not daughters of the 200 egg hens.

"The results of these investigations agree with those of other workers with plants and animals and show that the chief if not the entire function of selection in breeding is to isolate pure strains from a mixed population. It is found by actual experience impossible to bring about by selection, improvement beyond a point already existing in the pure isolated strain at the beginning."

If careful scientific men are not able to accomplish results with the trapnest, what may we say of the many amateur poultry men that are advertising wonderful laying strains selected by the trapnest: Just a bait to catch suckers. Don't be a sucker. Hark to the advice of Dr. Pearl at the close of his Bulletin No. 166, "Inheritance of Fecundity," as follows: "Until this basic question is definitely answered schemes and rules which involve anything further than attention to health, vigor and constitution in the breeding stock lack foundation in ascertained facts." Then we may solve the problem best by culling out the weaklings, breeding from the strong and vigorous, and making the environment congenial.

The difference in the egg laying qualities is primarily the difference in the functional activity of the reproductive organs, and these variations are very largely due to outward conditions.

Of the mature fowl all the evident characters for which she stands are borne into her, but the relative development may be due to the surrounding conditions. It does not stand that because special characters are strongly developed, in an individual they will be transmitted with increased intensity because of extensive development in the parent. The results of good food-nutrition are transmitted to the offspring in the form of vigorous constitution and large powers of assimilation and service. The above are some of the facts that we gather from a careful study of Dr. Davenport's work.

There are some strains of the breeds that are much better producers than other strains it is true. The study into the facts show that the strains of fowls that are known as great producers possess as a race a superior vitality and a very favorable environment.

The housing of the fowls has much to do with vigor, hence effects the profits. Prof. Graham, of Guleph, Canada, tells me that in a five years continuous experiment the hens kept in open front houses have averaged thirty per cent. more eggs than those kept in tight houses. This is in accord with experiments at the Minnesota, Maine, and other Experiment Stations, and my experience bears testimony to the value of fresh air and the open front or fresh air house at all times in the year, Winter and Summer.

I have not yet been able to find a commercial poultry business that has made a permanent success where intensive methods and close yarding has been practiced. This despite the fact many books of secrets and systems are being advertised wherein are wonderful statements of great profits on small areas. Show me one that has made money for the owner for five consecutive years. Colony houses on free range seem to be about the only solution of the problem when it comes to a permanent business for profit in a commercial way.

The houses must be as cheaply constructed as is consistent with convenience and fair durability. At Woodbine Farm the cost of housing is not over thirty cents per head. Many are housed much cheaper than this.

The profits of the poultry business are made not only in securing good prices for the product but in producing the product economically. Economy of production must be closely studied if we solve the problem of profit in the business.

Artificial methods of hatching and rearing the chix must be used where large numbers are desired. The problem of renewing the flocks from year to year is a difficult one. We have solved it fully well by using good vigorous breeding stock and using no eggs over three days old has helped much in getting good hatches of strong vigorous chix. The chix need no feed for at least three days after hatching. The Kansas Station found the best results were to be had by giving the chix no feed till they were ninety hours old. We make the first feed of green grass finely cut; and try to keep as close natural lines as we can. A study of the composition of foodstuffs and animal nutrition has enabled us to so feed as to have the chicks live and grow.

The importance of green grass for growing chix every day from the first feed is not properly appreciated. The food for the growing chick must be highly digestible and contain but little crude fiber and must furnish the elements required for growth. For this reason we use chiefly cracked or pealed corn, beef scrap and a little coarse wheat bran with plenty of green grass and some raw potato. That fool idea of our grandmother that chix can be artificially reared successfully only in small flocks must be abandoned if we get the cost of renewing the flocks down to minimum. For several years we have had excellent success with two hundred under one hover, and this season are trying four hundred and fifty more under one hover in an eight by ten portable house. We use all portable brooder houses that the chicks may each year be reared on clean land.

We deem it highly advisable to have the chix reared on about the same foodstuffs which they will receive when mature. We are sure that better results can be received. Of course we vary the proportions to suit the varying needs of the birds at various stages. After years of close study of the science and practice of feeding and the science of animal nutrition and its application to poultry feeding we are at last able to get the whole thing into very simple form, and yet embody all that science has found out, using an economical ration and getting results. There are three things that are absolutely necessary to the economic production of eggs on the farm, especially in a large way: Namely, open air colony houses on free range and a feed composed of corn, beef scrap and oyster shells. These factors must all be used in combination. We cannot expect results by ignoring one or more of them.

The Kansas Experiment Station found the above combination to produce eggs most economically and it is in perfect accord with our experience. At present we are using a little coarse wheat bran mixed with the dried beef scrap. I am not at all convinced that a variety of expensive foodstuffs is necessary with the fowls on free range. In fact my experience is to the contrary. Neither am I persuaded that laying hens need very much exercise under the above conditions. Probably I am like Josh Billings in that, "I know a whole lot that isn't so."

Some years ago when Prof. Brooks, of Massachusetts Station, made the statement that for best results in feeding for eggs we must eliminate a large part of the crude fiber from the foodstuffs, many would-be poultry experts were not inclined to accept the Professor's statement, which were based upon a lot of original investigation and experiment. I am fully convinced that Prof. Brooks was right. The results at the Kansas Station are further proof to the point. In a ration of corn and beef scrap and the grass and clover from the range, we have a ration with near the minimum of crude fiber, speaking from the practical standpoint: Reducing the crude fiber means a more highly digestible ration.

In every egg produced we have coming together two of the most exhaustive processes in nature—the secretive and the reproductive. It is one of the highest laws of nature that any animal will sacrifice her vigor or even her life if need be to produce a perfect offspring. This law is necessary to the perpetuation of species under the adverse conditions sometimes prevailing in the United States. It is

evident that when the hen is laying a large number of eggs we must study all sides of the problem. The vitality of the hen, the digestibility of the foodstuff, and to the furnishing to the hen everything needed to produce the egg and to maintain the vigor of the fowl. When we neglect these things we cannot hope to realize on the possibilities of the race to the extent we should. I am inclined to the opinion that the absence of shell material is limiting the egg yield of many farm flocks. I have observed hens trying to pick the mortar from the barn foundation in a desperate effort to get a bit of carbonate of lime for shell making. It would be interesting and profitable to follow some of these problems more in detail but time fails me. It is only by working out the details as each individual finds them that great success is assured.

SOME REASONS FOR POOR HATCHES

By W. THEO. WITTMAN, *Allentown, Pa.*

Being the last speaker for the afternoon and the hour growing late an endeavor will be made to greatly curtail this address, aiming to touch only the most important or vital points and then lightly or briefly.

The audience will notice that my topic even originally had in mind only touching on "some" of the reasons for poor hatches. It would be utterly impossible in one address to cover all the reasons why eggs hatch poorly or not at all, so intimately is this process of reproduction in the chicken interwoven with the arts of breeding, feeding and keeping. For popular opinion to the contrary, successful poultry craft involves a multitude of details and knowledge, which must be mastered and studied ere we can expect anything like uniform success or a clear understanding of the many principles involved.

Hence it follows that usually to attain any success with poultry, it is necessary to be an enthusiast and have what might be termed "a poultry knack." From this I would not wish anyone to gain the impression though that not a great many more farmers might not take a greater interest in poultry and it is one of my regrets this afternoon as I stand here before you that I lack the personality and oratorical powers to present this poultry problem to you in such a way as to more thoroughly arouse your interest and enthusiasm. Because I am very sincere in my belief that perhaps as many as six in every one hundred farms we have in Pennsylvania could be devoted largely in part or as a whole, to poultry raising and egg production, thus adding many millions of dollars to the annual poultry products of the Commonwealth and to the income accruing to its farmers. For after all when all is said and done whether in speaking of large intensive poultry plants or so-called "systems" for the village and city poultry keeper, the farm is, and

always will be, the one place for poultry. The farmer too by thus taking up a line of specialty farming, like poultry keeping, is provided a surer and larger income than is now being obtained by a close adherence to general farming. The work with poultry is not hard; is adapted to many people and is not even difficult to master, if common sense, perseverance and a faithful amount of study and observation be used and thus bring us to one phase of poultry keeping—reasons for poor hatches and all the train of evils and disappointments usually attendant therewith.

Now if we will only remember and be firmly convinced that it is Nature's idea that every egg laid should hatch and every little chick (barring of course, being destroyed by natural enemies) should live and that every departure from this is the fault of man (usually ourselves) the reasons our eggs won't hatch and our little chickens won't live ceases to belong to the realm of the mysterious and becomes something for us to set to work and find out the reason why, or where we have lacked.

Oftentimes the evil results, showing in the failure of our eggs to hatch, are due as much to our sins of commission as omission. An illustration of large proportions of this was afforded all over Pennsylvania in the spring months just gone by. During all of February, the month when the first early chicks arrive, the complaint was general among village, city and farm poultry keepers that eggs were hatching poorly. The reason generally assigned was, the cold and severe winter weather. When Spring opened early and gave an exceptional early and favorable season for poultry on the farm to enjoy free range or lead a normal life or something approaching same, eggs quickly began to hatch well and from all reports I have had, the chicken crop on farms within the State this year is large and doing exceptionally well. But for the village and city poultryman, the long cold winter with snow on the ground almost without a break, greatly aggravated and accentuated the effects of the usual shut-in conditions such poultry is subject to, and poor hatches and bad hatches continued all through April and it is only within this last month that poultry keepers of this class have been getting anything like fair hatches.

In other words, farm eggs generally hatched poor early in the season and eggs from shut in poultry hatched poor until very late in the season. On the other hand I know of some poultrymen whose eggs have hatched well early and late and who have got to the point where they are reasonably sure of this being the rule year by year. These poultrymen did not commit the grave error of simply idly letting the snow and storm of a severe winter rob their poultry of exercise, fuel, pure air, of green and of animal food. These poultry houses were wide open every day the sun was shining and every night it was not storming or too severely cold. Arrangements were such that sunshine flooded the houses and a daily chance at a dust bath was not neglected under ideal conditions. There was a board floor in the house so that the litter, a foot deep thereon, might remain clean and dry. All grain was fed in this litter. So also was grit, oyster shell and coarse beef scraps. Not too much mash was fed and this had a liberal proportion of green cut clover or alfalfa. (By "green" is meant young clover or alfalfa dried in the shade retaining its green color and high value as a substitute

for true green food). Any reasonable, thinking person will readily believe that hens thus kept and fed will stay in good breeding condition and will lay strong, hatchable eggs or, in other words, good, meaty table eggs of fine flavor.

For next to the breeding stock, we must consider the egg itself as a prime factor as to whether our hatches are to be good or poor. An egg is simply a new chicken and in direct proportion as to how the egg contents approach ideal proportions to build or nourish a new chick do we get hatching results. For instance, both inner and outer albumens may show too much water or, be in fact, watery. You can't make (hatch) a chick out of such an egg. Or, managing to mature a chick within the shell it may never emerge, or hatching, be a weak chick impossible to raise.

No thinking man can accept the theory that an egg is an egg, even though same be new laid, when the difference on opening two equally fresh eggs may be easily perceptible to the naked eye or in use be differentiated by the quality and flavor.

A poor table egg is a poor hatching egg, excepting of course the more fertile egg, or an egg laid by hens that on the range may have access to food not affecting their health or the vitality or quality of the egg for hatching and yet affecting its flavor as a table egg.

The egg must furnish the elements of growth for the developing chick and if they are not there the germ dies no matter how strong said germ may have been originally.

It will be seen, therefore, that having good eggs it is highly important to preserve the contents of them as nearly as is possible in the condition they were gathered. The easiest and safest way to attain to this is to set them as fresh as possible. During cold weather they simply must be gathered often and I consider a temperature of 60 much safer than one of 40 in which to hold eggs awaiting to be set. To set such eggs on end, to bury them in bran or do similar things to them is worse than foolish. A basket, perhaps lined with paper, is one of the best receptacles and allow eggs always to rest on their sides or in their natural position and turn or roll over every day or two.

On farms the ideal results before spoken of "of every egg hatching" might be more nearly attained if farmers generally would pay only a little more attention to the selection of their breeding males. The male is, weighed in the breeding sense balance, half the flock. He should be the embodiment of vigor, vitality and full flowing health. Without question, a pure-bred and if his owner knows his dam to a certainty and has had him under observation while growing up so much the better. He should be in his prime as to age and in every way thought of, treated and handled as becomes the valuable animal he is. Very old and broken down hens, hens showing they are low in vitality in a farm flock mean, no matter what the male is, or the feeding or the housing, some eggs in every clutch that will fail to hatch. Broadly speaking every farmer would be better off if he would cull his hens one-third to one-half, breeding season or no breeding season, and if he would spend a few dollars in a pure-bred sire or sires.

Next, the great question of incubation. All that has been said up to this may be nullified by faulty incubation. The farmer, carrying a flock of a hundred or less laying hens of the so called

general purposes fowl, has no use for an incubator. Or in plainer words, is usually better off without one. Although the veriest tyro may frequently have splendid success with an incubator, the fact remains that the average individual will get better chicks and more of them if he trusts incubation to the old hens instead of dividing it between himself and a heated box. That artificial incubation though is a success in the hands of skilled operators is proved by the immense trade that has grown up in the last few years in day old chicks all of which are hatched artificially. The question of artificial incubation though is too complex and too lengthy to enter into this afternoon, except to mention that the reasons for failure with a certain machine or machines may sometimes be obscure and entirely unsuspected. I found one machine this season that had always done well and which, upon investigation, was simply clogged up with heavy spider webs having been stored on a dirty barn floor.

In conclusion, we heard here this afternoon testimony from half a dozen of you that hens stealing their nests, usually made large hatches. Then let us study the reasons therefor, for reasons there certainly be. For instance let us study the nest. Few of us know how to copy the nests made by this hen. Usually an almost flat hollow in the ground with a few leaves or a little litter made by the hen loosening the earth with her feet, pushing it to a ridge at the sides, moving her breast bone in a circle and pulling in the small amount of litter or lining with her bill.

THE FARMER AND HIS RECREATION

By ENOS H. HESS, *Lancaster, Pa.*

The farmer is one of the prime factors in a nation's material growth and development. His is the class that not merely manipulates but produces the wealth; the class whose products if withheld for but six months would cause starvation to the peoples of the world; the class that produces the brawn and brain for the leaders of all classes; and, with all, the class that is made the subject of sport by the joker and cartoonist.

A reverend gentleman in giving an address of welcome to a farmer audience indiscreetly referred to the biblical fact of the first murderer being a farmer. The respondent politely told him that only half the truth was stated; that upon that farmer becoming a murderer he was no longer fit to be a farmer and "Cain went and built him a city." Ever since have the cities been the contaminating and destroying influences of the world.

We have never done business in Wall Street nor do we contemplate it. But if one goes to the clothier at present for some garment he is told that all cotton goods have advanced in price on

account of the frost. The question arises in one's mind, was it Jack-Frost or Wall Street frost that did the greatest amount of damage. Our government has spent and may well continue to spend large sums of money for the enlightenment and uplift of the farmer through scientific investigations.

Recreation means a giving of fresh life, reanimation, inspiration and diversion; not dissipation, alcoholism, tobacco using and such like so-called but misnamed recreations. The trinity of man, body, mind and spirit, must be kept in mind when considering the proper recreation for the farmer. The student and office laborer may find recreation in a game of golf or tennis, but a farmer secures recreation by a cessation of physical activity. The agitation for the eight-hour system is perhaps uncalled for, the farmer as he usually observes it quite closely. The only trouble is, he too often gets two eight-hour periods in one day.

During the pressure of seed time and harvest, extra effort and long hours are often necessary, but many farmers could, we believe, do better work and in many cases more work if more time were taken for recreation. There is no pleasure in driving a jaded horse; and the farmer who is constantly working to the straining point gets little if any pleasure out of life. The farmer's teams as well as his hands would often be in position to do better service by a shortening of the hours of labor.

Intellectual recreation is quite essential all to the farmer's well being and should be of a higher type than is often to be obtained in neighborhood gossip. We do not wish to exclude all neighborly visitation, but when it becomes too frequent, "familiarity will likely breed contempt." The daily press may be read with profit if done sparingly. The agricultural press should be and often is a means of new ideas and better methods, if one has enough adaptive ingenuity to assimilate rather than gulp the experiences of others. The same may be said of Experiment Station reports and bulletins. The Farmer's Institute is, if it is all it ought to be in management and speakers, a valuable means of inspiration and education.

If it is true, and we believe it is, that from the farm comes largely the brawn, brain and moral force to run the business of the world, there needs to be enough spiritual dynamics in the farm home to help its best product, the boy; to help build State Capitols without public scandal being connected therewith. One of the most successful lawyers of Lancaster when asked recently the key to his success replied, "His mother's prayers in the old farm home." We may wish to be wholly independent creatures and may profess not to need spiritual recreation through prayer and meditation, but if we do we are as the meteor that has left its proper orb and will meet with disaster as we get into atmospheres with which we cannot cope.

As per the universal law of gravitation for all physical bodies, there is one central force to which it behooves us as dependent, created and yet creative beings to remain attached in order that we may be enabled to work out the best in our lives for which we were intended. Thus, the time spent in church going, attendance at the mid-week prayer service and family prayer and devotion is not misspent but well spent, as it affords recreation to the spiritual life—the motive factor in right living.

EDUCATIONAL UTILITY

By DR. EDWIN EARLE SPARKS, *President of Pennsylvania State College, State College, Pa.*

My Fellow Workers: I hope that I shall be pardoned this evening if I occupy the few minutes I take in speaking along educational lines. This meeting is educational in its aspects, and I must congratulate Director Martin on the attendance and interest manifested here in this closing of the year's work. Institutes are all educational, and therefore I do not feel out of tune or harmony in speaking along the line of eduaction. Sometimes we complain that education changes and sometimes that no sooner do we get one thing established in the public schools or colleges than we immediately change it; we have the same complaint that as soon as our roads become good we repair them. It is true we make frequent changes; but these changes are simply adjustments to meet the new demands. We have no candle light here this evening and no one would think of going back to candle light. There is an electrician in this building to look after all these lights, in the days of candle light we had no electricians. I imagine in the olden days we should have had this room heated with a stove which scorched you on one side and froze you on the other side, so that a man might wish himself seated on a turntable. Now the building is steam-heated under the care of an engineer. My point is that there has come a demand for the electrician, and a demand for the engineer; that this change in our environment is constantly going on and as the environment changes so the education must change. It is true it changes slowly sometimes and frequently the need is greatly in advance of the supply, because we cannot determine what will be needed until after the need arises. I might, in this view define education as a constant adjustment to meet new demands made upon us. A few years ago we were satisfied with the bread made by mother; now we demand the best bread that science enables us to make. Then mother was dissatisfied when she had bad luck; now it is a case of thermometer with mother's bread and we have practically come to adjust all education along these lines.

Education has changed more rapidly in the upper portion of the curriculum than in the lower part; that is, our education has adapted itself much more rapidly to the higher demands of life than to the lower demands. The electrical department at the Pennsylvania State College is turning out about fifty electrical engineers this year, and every one has a place now in advance of getting his diploma. There is also a demand along the line of agronomy. We are training six or eight men in that course this year and every man has a position in advance of the time he will graduate. A few years ago there was no course in electricity, agronomy, and a school

of Domestic Science was not dreamed of; electro-chemical engineering was not known. These have come, of course, with the demand.

But take the lower grades of the school; is it not true that we are teaching just about the same subjects as fifty years ago? The change has come in the upper part of the line, but not in the lower. They are still parsing, ciphering and memorizing just as they did in the country school when I went there. I sometimes wonder how many of those things I have used since that time. We still have reading, writing and arithmetic as in the old days and I am wondering whether the time is not coming when we will demand a re-adjustment along these lines as we have secured it upon the higher lines. A short time since I was in a conference of school-teachers—I think there were no educators there—all school-teachers and practical people, just as I take it the people you address are all farmers and not agriculturists. There we were discussing these problems and somebody made the statement that all these years we have been giving the same kind of an education to the boy intending to live in the country that we gave to the boy that intended to live in the town. We began to analyze the situation. How many problems in arithmetic will lead the boy back to the farm? You remember the problems; so many yards of cloth at so much a yard. Does that lead the boy back to the farm. We used to have another: Bought 16 2-3 head of sheep. I was always worried about the 2-3 head of a sheep. I wondered how the farmer got that 2-3 of a sheep home. We had a few problems leading back to the farm but the most of the problems concerned yards of ribbon, of cloth, bookkeeping, accounting, etc.

Now is it not true that nearly every one in this room has his or her ideal. In the school room our chief task is to form ideals. Take the average boy and what is his ideal at present. His ideal is a man not above average height, a near-sighted man who has prominent teeth and a strenuous manner, he is mostly shooting someing; he is generally bursting something. That is the ideal of the boy at the present age, based upon the most prominent man in public life. If you or I could change the ideal of the corrupt politician in Pennsylvania—I don't know if there is such a thing—if you could take the most corrupt politician and change his ideal, get him to believe he ought to work for the public good instead of his private gain, he would cease to be a grafter. You make him realize that public office is a public trust and not, as he believes, that public office is a private graft. As I looked at the 1,400 boys at State College last Sunday I wondered what kind of an ideal was being formed by them. I believe our studies are not more essential in schools than the forming of worthy ideals.

Now take the country boy in school forming his ideals. As he works out his problems does he see himself following the plow? No, he sees himself capering in my lady's chamber, as Shapespeare says, and measuring off ribbon with his nails brightly manicured. He will not be a clodhopper, he intends to stand behind the counter. Does he see himself back at the farm? Rather he sees himself a bookkeeper, perched on a high stool, totting up columns in a ledger. Take again when we read the reading lesson, Shelly's Ode to the Skylark. Now the skylark is all right on the farm in England. But I question whether an ability to comprehend the poetry of the

Skylark, if the lad should ever hear one, would make him a better ploughman. Does that lead the boy back to the farm? How much is there in the reading lesson of the smell of the soil? How much of the dew of the grass, of the odor of the cows coming in at milking time. I claim we ought to have a different education for the boy on the farm from the boy in the city, but thus far I have been on the minority side. Most of the teachers seem to think that education is only for soil-culture and that whatever develops mental powers prepares for the future. Do you suppose that at the State College we give the same course of study to the boy who is going to be a forester that we give to the boy who is going to be a mining engineer? Yet that is what we do in the lower grades.

Let us first find out if possible what the boy intends to do. Let us start on the presumption that the boy intends to live on the farm and the girl intends to stay on the farm. I will not deny the attractiveness of the city. I heartily endorse everything a previous speaker said on the subject. The city has the advantage in comparison with the country; the five cent theatres and the show windows, the music and the lights, all the temptations as well as the legitimate attractions naturally lure boys from the farm. We ought for that very reason to make the country life appear more attractive. Take the boy who graduates from the country schools. He has finished his course up to the eighth grade of the average country school, or, go further, and say finished the township high school. He wants to be a farmer and intends to be a farmer. He has found the blessed ideal of wanting to be a farmer. He knows arithmetic and algebra along the line of mathematics and is going to use his algebra on the farm. How will he use $a^2 + a^2$ on the farm? Will be a better farmer on account of his algebra? Perhaps he has acquired a taste for good reading; blessed is that boy if he has gotten that taste. But how will the appreciation of good literature conduce to judging a horse or a cow? He has studied geography and he knows where the Mountains of the Moon are. Now he proposes to go out and spray an orchard with that information. So far as the school course is concerned he goes out into the orchard and he does not know whether to spray

The girl when she gets through school has no idea how to dress herself properly; she has no preparation to match colors; and if she has to make a dress she goes and borrows a pattern from a neighbor and fits it to her proportions. If she goes into the store to buy goods, she has to depend upon the honesty of the clerk. "Will these colors run? Is that flimsy or shoddy?" She cannot tell and judge these things as she could do if she had studied domestic art in the school room. In her house she puts pictures of all kinds in all places and she builds a house with a Queen Ann front and a Mary Ann back. That would all be corrected if she had some learning in domestic art.

Are we giving the boy or girl who intends to live on the farm a fair chance in the schools? Here is a boy who has finished his course and can parse from A to Z, but he has not an idea how to put a machine together or take it apart. He could not put up a wind mill. So far as the soil is concerned he cannot tell acid from alkili. Whatever information of that kind he has gotten he has picked up outside of school. The country boy has the same right to get this information and the country girl has the same right to

get her information that the boy who intends to go to college has to get Greek and Latin and he should demand it. I will agree with you that culture is a good factor in life. I will agree that the ability to appreciate good music and works of art adds to the culture of the human soul. But that is not all of education. We cannot live by culture. I should want to have something of what may be called the utility factor of education as well as the cultural side of education. How is this to be done? It will never come save by the demands of the people most interested. Is the city bookkeeper the one most interested in this? He is not interested enough to do anything. Is the counting house man interested? No. You are the ones. It will come precisely from the people interested in agricultural affairs, in rural live.

But there is a preliminary work to be done. Suppose, to illustrate, we take the county superintendent. Suppose you go to him and ask to set the examination questions for the next examination for teachers and he permits you to do so. The first question will be a question on soil testing; the next will be the value of nitrogen in the soil; the next one of the growing of alfalfa; the next on stock judging. How many of his teachers will pass that examination? The next question will be on the buying of goods so as to test good fabrics; the next question will be hand work and basketry; the making of hats, so that the girl who is going to be a house wife can make these things herself. Probably ten teachers in the county could pass that examination; and whoever passed it would depend upon the general information he had found for himself. The difficulty is to get the teacher who can teach these practical subjects. We have got to begin at the bottom and teach the teacher first and then the teacher will teach the pupils. I believe firmly and fully that we are going to make a revision, but it must be done gradually. We are going to introduce gradually into the country schools of the State of Pennsylvania this very information that I am speaking to you about. But not in an intensive way; we can't set up a laboratory in every country school. Only the essentials can be gained there. You cannot put up an experimental engine in every school; but you can teach the principles of rural engineering there so that the farmer's boy will know something of it. We cannot teach every boy all the different kinds of fruit and budding, etc., but we can get the principles established so that the boy will recognize what is the matter with his fruit tree, so the girl can recognize what is the matter with her rose bush and how to treat it.

These things can be done and I believe will be done by first educating the teachers. In the second place, the utility of education, so far as the college is concerned, faces a standing problem and that has been in trying to get the information from the college to the people. You and I know that the United States government is spending hundreds of thousands of dollars over the United States, giving upwards of $60,000 to the Pennsylvania State College alone, for the purpose of carrying on the experiments in agriculture. How are we to get the results of those experiments to the people? You are the medium largely. You carry out the information from the central office to the distributing point. But the difficulty is, barring your speaking to them, that we have been depending largely on pamphlets. Now, the farmer does not go to the pamphlet

naturally for his information. The common idea is that the farmer simply sits in a large easy chair and has nothing else to do but read pamphlets. Perhaps he reads a pamphlet in the Winter and wishes to apply the information; but he has to do something else in the meantime. By the time he gets to seeding his clover, he forgets what he had read about it. In other words, the pamphlet appeals to him at the wrong season of the year, and consequently it has been a slow task of getting the information to the farmer through the pamphlets. How did my father do? I remember as we rode through the country to the camp meeting he and mother would discuss the planting, the farm-buildings and appearance of the farms we passed. I know now that he would rarely come back from the camp meeting without some physical good as well as spiritual good. He was taking notes on the way to and fro. It does not take an observing farmer very long to see how time changes the way of doing things. Yet we tried for a long time through pamphlets to disseminate this information.

The next method was by lectures both in your Institutes and in our instructional trains running through the State. The farmer will gain information much better from the lectures than from the pamphlets; but as a rule even this is not the way he gets information. He was not sent to a college, when he learned how to take notes.

The third way of getting information to the farmer is the way we are now trying to do at the State College and this is to bring the farmer to the college. Do you realize that in the State of Kansas 20,000 farmers visited the State College and every farmer who came there saw something and took away some ideas with him. Think of the men who passed through the dairy building and saw how to keep their milk clean. Few ever saw before in their lives the growth of bacteria as they saw it on the culture glass there. How many farmers before that time had seen the effects of a small piece of cow dung dropped into milk and allowed to stay for twenty-four hours. When the farmer sees that he learns the value of clean milk. When he goes over the experimental plots at The Pennsylvania State College,—some of them twenty-eight years old; that is for twenty-eight years these have had a rotation of crops, first one crop and then another, some with various kinds of fertilizer and others which have never had a particle of manure or commercial fertilizer and these he sees all grown over with red top; and next to it perhaps is the plot that has had only barnyard manure. He sees all these plots and he gets a lesson and he goes home convinced; and to my mind with a thousand pamphlets or 500 lectures you would not convince him the way going there and seeing it himself would convince him. For that reason we are trying for better railroad facilities at State College, and I am taking this opportunity to advertise to that extent; I want your help. We are after the Pennsylvania Railroad Company. We are camping on their front steps at present, trying to get better railroad connections. Nine miles of railroad built over a sandy region of comparatively level ground would connect us with the main line at Tyrone.

I met a man the other day at Clearfield, who told me that he went over to the State College winter before last and stayed there during Farmers' Week. That was six days. He said that he came home

and that year increased his strawberry crop five times. Just one week of six days he was there. I want the help of all of you as far as your influence goes with the Pennsylvania officials. We had twenty of their leading men at the college this week. They know that the railroad has got to haul something besides people in order to pay dividends. They have hauled about all the timber they will haul out of Pennsylvania for some years. They know that the mining resources are exhaustible. What else is the road going to haul? It must depend upon what it produces from the soil because that is everlasting. The farmer is the producer. The railroads understand that now. I suppose there are twelve demands on file now at the college to run these farmers' instruction trains over different roads in this State. Every division superintendent is alive to this.

To-morrow there will arrive at the Pennsylvania State College forty-five men coming in a special train from the Cumberland Valley. They are going to stay there two days. Who are they? They are the station agents, and the railroad is sending them there at its own expense and going to keep them there for two days. Why? So they can go back home and be agricultural missionaries. They expect these station agents to tell the farmers what they have seen at State College. They are wakening up to that. I want your help as far as it may be in this thought of trying to get them better railroad facilities so that the people may reach the college and get their information direct and in that way your work will be supplemented by their personal observation.

Another point I want to make. We are coming to another session of the State Legislature. The Pennsylvania State College is a dependent State institution. It has no permanent endowment. The proceeds of the $12,000 Mr. Carnegie gave, goes to pay the room rent and incidentals of the scholarships. From the United States government land grant proceeds, the State pays the interest on $500,000. What a pitiful foundation for the child of the rich State of Pennsylvania. Yesterday I read that Princeton gets $10,000,000. If we only could get one million. Who is going to give us $10,000,000? The colleges that get the money are located in or near the cities and the money is in the cities. If the man in the country does make money he takes the first train for the city. We cannot expect much in this State in the way of endowment. We have to depend year after year on the session of the General Assembly and you men and women have been loyal in your support of your State College. The criticism is they say we demand more and more money. Why? Because the students are coming more and more to this free school. Do you realize that the attendance has doubled in five years? Every additional student is an additional burden because he does not pay any tuition? If we could get an average of $900 a year for 1,400 students the problem of maintenance would be solved. We had 453 Freshmen enter this last year. Next year it looks like 600. We have recitation rooms in the garrets and basements and everywhere trying to take care of them. We don't want to turn them away. This increased sum of money has got to go for an increased number of teachers, increased machinery. Some of the buildings are good imitations of wooden structures, with tarpaper roofs,—temporary buildings. And above all the School of Agriculture is growing! Over 400 students this year and twenty-five graduates.

Everyone of the graduates has a position now in advance,—a greater demand than can be filled,—and how are we going to take care of the additional agricultural students next year? We must have more buildings and they must come from the Legislature through your support.

SOUTH AMERICAN AGRICULTURE

By E. M. BAXTER, A. M., B. S. A., *Mifflinburg, Pa.*
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You are aware, of course, that the great highland region of South America lies close to the Pacific Ocean. It varies in width from about one hundred to more than six hundred miles, and extends from the far north to the extreme south of the continent. In many places it rises with considerable abruptness from the Pacific to heights varying from a few hundred to several thousand feet, seamed with deep gorges and gullies cut by the torrents which have their origin in the melting snows and glaciers of the Arctic summits of the Andes.

The highlands of the east, the lesser system of the continent, are roughly triangular in form, the sides of the triangle being nearly equal in length. One side faces the Atlantic for a distance of some two thousand miles, having the angle opposite over fifteen hundred miles from the coast, near the point where the falls of the Madeira obstruct river navigation into Bolivia. The eastern highlands are much lower than the western, have only about half their area, and are chiefly within the tropics.

A large part of the continent is lowland less than a thousand feet above the level of the sea. In some sections the lowland is very flat, but generally its surface is marked by a great diversity of hill and valley. It extends from about six degrees north of the equator to forty degrees south. Much of the western highland is barren, but the pocket-like expansions of the valleys where irrigation may be practiced, and the foothills on the east, the total aggregating only a relatively small area, however, are fertile, in places extremely so.

A narrow belt of desert, alkaline and saline in nature, in places more than three hundred miles wide, lies on the lower slopes of the Andes and the lowlands to their east, extending from within the tropics almost to the Straits of Magellan. Wherever irrigation is possible in this barren region bountiful crops may be produced.

The lowlands and eastern highlands are characterized by great tracts of forests, and vast, treeless, grassy plains. Swamps thick with rank reeds and other coarse water plants are common. In places the forests are open, offering only slight obstacles to horseback travel, but in many extensive districts the trees, shrubs, and vines are so intergrown that the explorer must cut his way through

with ax and knife. On the plains there are great areas having so dense a growth of tall grasses or thistles, wild pineapples or other matted annuals, that the horseman finds it almost or quite impossible to force his mount through.

Springs are not as numerous as they are in our own Alleghenies, but there are many cascades and waterfalls in the mountains, both east and west. Nearly all the larger streams overflow their wide, level valleys every year, the flood period corresponding to the period of heaviest rainfall in the wet season, a period generally lasting several weeks.

Although the major part of South America is in the torrid zone, there is a temperate region comparable in extent with the United States or Europe. The temperate region includes the upper plateaus and valleys of the Andes within the tropics, a small part of the tropical eastern highlands, and all of the continent south of Capricorn, with the exception of the Andean summits. That is, temperate South America comprises a large part of Venezuela, Columbia, Ecuador, Peru, and Bolivia; a small part of Brazil; and practically all of Chile, Uruguay, and Argentina.

Naturally, the agriculture of the vast tropical territory of South America is limited to the products of the torrid zone, products to which the American husbandman gives little direct attention because they are so different from his own crops. On the other hand, the farmers of the United States are becoming more or less concerned in the possible products of temperate South America because of the reiterated reports that the cheaply produced grains and meats of this territory are on the point of gaining control of the foreign markets we have come to look upon as our own, and because of their supposed likelihood to invade our domestic markets within a very few years. We shall see shortly how little foundation there is for these predictions. Throughout all the great temperate territory of the continent, a region of a thousand million acres, all the field, orchard, and garden crops, and all the domestic farm animals, of temperate climes will thrive. Here is a domain capable of feeding and clothing well hundreds of millions of people, yet anomalously the continent's sparse population of barely sixty million draws a considerable part of its food and clothing from foreign farms.

Cattle graze over all parts of temperate South America, and in the open forests of Brazil and Paraguay, not wild and unclaimed as was the case a few decades ago, but in branded herds that are coming to be cared for and managed with no inconsiderable skill by many ranchmen, although some still receive only the most primitive attention. No reliable information is available from which to determine with any degree of accuracy the number of these cattle. They can hardly exceed 50,000,000 head, and possibly are no more than 35,000,000.

North of the Tropic of Capricorn inferior sheep are found in small numbers, but farther south they feed in ever increasing flocks of better breeds. They number not over 120,000,000 head, and may be even less than 100,000,000.

Horses run wild or half wild throughout the temperate parts of the continent, but in the tropics they are rare, speedily succumbing in all hot districts to a disease known as *mal de cadera,* a malady

probably carried by blood-sucking insects. It is doubtful if there are 15,000,000 horses in all. There are probably 5,000,000 or 6,000,000 mules and asses, the former being generally used instead of horses in all inhabited regions of high temperature.

Swine have taken to every part of the continent settled by the whites, they thrive nearly everywhere, yet it is likely that there are less than 5,000,000 all told, with little if any annual gain in numbers.

There are goats up to 2,000,000 or 3,000,000, kept for their flesh and skins, and there are 20,000,000 or more head of poultry—turkeys, geese, ducks and fowls.

The staple grains, vegetables and fruits are unknown as farm crops in most parts of South America. Many different varieties are sparingly grown in small garden plots, partially to meet private needs, but practically the only region in which they have gained an economic place of more than local importance is the Pampas of Argentina and Uruguay.

The Pampas is the region from which have come the wonderful stories of the meteoric rise of South American agriculture. Here is the territory, which, according to some vision-seeing travelers and writers, will soon force the farmers of other lands into a condition scarcely better than serfdom, for these seers already see the Pampas producing unlimited quantities of meats and grains, butter and cheese, fruits and vegetables, wool and hides, flax and cotton, at prices so low that even the poorest of the world may be fed and clothed like princes. Without question the Pampas is the key to the South American agriculture of the present, and it will remain the key for several generations, at least. It has a genial climate; a fairly fertile soil all ready for the plow, although subject to long periods of drought and the devastation of great swarms of grasshoppers; all sections are within easy access of river and ocean; and life and property are as secure there as in any other part of the continent, indeed, more secure, than in many other districts.

The other sections of temperate South America are also rich in climate and soil, but they are difficult of access; their sparse population is generally antagonistic to foreigners and uncongenial to people reared under the enlightenment of the United States or Europe; and the life and property of the alien are far from safe, especially outside the policed districts of the larger towns and cities.

During the last seventy-five or eighty years small numbers of men from our own country and greater numbers from Europe have gone into the temperate districts to engage in farming, generally in ranching, except that some have "taken up" grain growing in recent years on the Pampas, with a liberal measure of success, but at the sacrifice of most of the amenities of civilization, living and rearing their children far from the refining influences of people of even moderate culture, and subject to the bestial practices of a degenerate Christianity.

For instance, in eastern Bolivia there is a family of north European stock, stock which in the United States has produced men of the highest standing, living hardly better than the debased "greasers" of our own Southwest, although "rolling" in wealth. About forty years ago this man and his wife emigrated, taking with them a few hundred dollars, and ascending the mighty La Plata far into the interior of the continent, lured by the glowing prospects of

becoming great land owners and stock raisers. They bought land at a fraction of a cent an acre, a few score cattle were purchased for hardly more dollars than there were animals, the necessary horses were procured for the proverbial song, and the road to wealth lay before them—if all went well. They shrewdly managed to make friends of the few people, especially the government officials, in the wilds about them, thus escaping much of the open plundering generally meeted out to foreigners living as they did.

From a fifteen-by-fifteen hut their dwelling gradually grew into a cheerless, uncouth, rambling, low structure of half a dozen scantily furnished rooms; children were born to them; livestock multiplied; and their acres broadened. Here we have practically the sum of their existence; not a friend nor an influence to help lift them above the lowest plane of a white man's life. They have an abundance of lands and stock; they have gluttonously fed bodies; they have dwarfed intellects; and they are destitute of all the finer things of modern, civilized life. I leave you to say how desirable is such success.

Down on the Pampas, not far from the fair city of Buenos Ayres, in much the best district of all South America for the farmer of any degree of refinement, is a family which was established there almost a hundred years ago. The first of this Argentine line was also from the north of Europe. Without money, he began to work his way upwards by herding sheep "on shares." He "knew sheep," he was ambitious, and he believed the Pampas was destined to have a bright, if not a brilliant, future. Every dollar earned was put into sheep at first, then cattle, which were for some years grazed on the public lands without any payment for rent. Later on, with the accumulation of tens of thousands of head of stock, land was bought in large tracts at only a few dollars per hundred acres, until a property in excess of two million acres was in hand. In the meantime a wife had been brought out from the home land, a comfortable dwelling was erected, teachers were employed at home for the children, intercourse was maintained with congenial friends, and a touch, although rather loose, was kept on the progress of the world through books and periodicals. Occasional visits were made to Europe, and when the boys were ready to go to college they were sent to the best institutions in the Old World. They in turn made provision for their children to advance a little farther on the road of progress than they themselves had gone, so that to-day, the families of this line, although not in the inner circle of the aristocracy of the country, are persons of intelligence as well as of means. Their notions of life show the taint of the people among whom they dwell, yet they are very much superior intellectually and morally to the family referred to above.

But for every instance of success on the part of foreign farmers, there are scores, aye, hundreds, of instances of heartbreaking failure, failure not due to any lack of effort or spirit on the part of the immigrants, but to the tricking of the "natives" about them. It would be possible to tell you the pathetic stories of hundreds of individuals, and even of numerous colonies numbering dozens of families each, who were lured into one country or another in South America in the not very distant past under promises of special government aid, and with apparently golden prospects, only to discover eventually that they were the "game" of men scarcely less diabolical than

their ancestors, the "*Conquistadores*," who ruthlessly drove the Indians under the lash into the mines and forests to wrest from ore and tree the fortunes craved by them.

One example only can be given. Some years ago a number of men of high estate in one of the Andean countries devised a scheme to increase their fortunes without expense to themselves. Their plan was to have the government enact a law whereby the nation should pay the passage of several hundred immigrants from Europe, provide funds for their maintenance until they became self-supporting, and supply them gratis with the equipment necessary to establish them on virgin land and convert it into tilled farms. The immigrants were to be colonized on the lands of such citizens as might make provision to conform to certain conditions specified in the act.

Several of the schemers crossed the Atlantic to act as agents for the *combine* among the peasants and small farmers of Central Europe. The offers and promises made by the agents were so liberal, and their claims to be acting for their government seemed so convincing, that would-be emigrants were eager to go to the *El Dorado* pointed out to them. The agents reported their success to their fellow schemers, and the bill was presented to Congress and speedily became law. In the meantime the agents in Europe selected the several score families provided for in the measure, and laid their plans so that within a few weeks after they received word from their confederates at home that the law was on the statute book they embarked with their colonists.

On arriving at their destination in South America each immigrant family was placed on a tract of land varying in size from fifty to two hundred acres, according to the number of persons in the family, the understanding on the part of the settlers being that the land was sold to them subject to payment in a number of annual instalments out of the proceeds of their toil. For several years all went well with the colonists; there were no taxes, as the agents had promised; the land was brought under cultivation; buildings, some of them good brick dwellings, were erected, and tobacco, cotton, sugar cane, the vine, coffee, and other crops and fruits were planted. Prosperity seemed to smile benignly on the immigrants, and they "blessed the lucky star" which led them to this eden.

But about the time the vines and coffee trees began to bear well and the land was giving assurance of bountiful crops, clouds rose rapidly above the horizon on all sides. One or two of the boys of each family was conscripted into the army. Several of these were only sixteen years old. Next, a poll tax of several dollars was laid on each member of every one of the immigrant families. Then, a number of the girls were forcibly taken as servants in certain of the families of high government officials, receiving no wages, and being placed on the level of concubines. When the period came to a close during which the colonists were making yearly payments towards the purchase of their farms, as they supposed, and they asked for their titles, they were informed that the payments had been made as rent, not as purchase money. Furthermore, the farmers were notified that a material increase in the yearly payments would be required of them thereafter, otherwise they would have to vacate the properties held by them. Naturally, the colonists were alarmed and indignant at this turn of affairs, but they soon discovered that

the schemers had everything legally in their own favor. The farmers had no disinterested evidence that they were to be exempt from taxes, that their sons were not to be conscripted into the army nor their daughters *employed* as household servants, or that the annual payments made by them were purchase installments and not rent. On the other hand, the schemers had an array of documents signed by the farmers themselves showing that everything done was done in accordance with the agreements made by the farmers over their own signatures. Appeals to the courts and consuls were therefore fruitless. Despoiled of numbers of their children, and robbed of the toil of several years, the colonists were forced to remain practically as serfs on the land they had developed, for there was almost no opportunity to secure work elsewhere, and there was nothing they could convert into money with which to flee from the region and country which had treated them so foully. Eventually some drifted off to other parts of the country, and a very few succeeded in getting away to other lands, but most of those who survived the calamitous ending of their aspirations are to-day dragging out a miserable existence under conditions far worse than those of the gentry-ridden lands of their nativity.

It is only fair to say that during more recent years conditions in most South American countries have improved to such a degree that there are very few in which such brazen plundering schemes as that outlined are likely to be tolerated now or in the future. Many parts of the continent have come to recognize the desirability of standing higher in the world's public opinion than they stood in the past, an opinion which demands that foreigners of all classes be given a "square deal" in any and every country. The Pampas is in the forefront of this change towards immigrants, because this region has the most extensive commercial relations of all South America with lands across the ocean, and Pampas land owners are beginning to see the great material advantages which they are likely to derive from the development of their country through the investment of foreign capital in industrial pursuits.

All through the centuries since its discovery, explorers and colonists have been taking domesticated plants and animals in small numbers to South America. Until very recently the new environment, in most cases, was so different from the old that plants and animals generally were unfavorably affected by the change, selections having been made without regard to the peculiarities of the regions to which they were transplanted. Thus, Old World varieties and breeds were commonly disappointing, leading gradually to the belief that the soil and climate of South America are unsuited to very many of the plants and animals of the north temperate zone, the plants and animals of greatest economic importance to the world.

For instance, wheat was tried in many parts of the continent, always proving a failure for milling purposes until suitable seed was "accidentally discovered" a few years ago. Corn, although grown in small plots by the Indians for centuries, after almost innumerable attempts at field production in widely separated districts, came to be looked upon as an impossible commercial crop. Alfalfa, clover, timothy, blue grass, and other well known pasture and meadow plants, seemed unable to get a hold on farm land. The

fruits and vegetables common to our latitudes, with few exceptions, became coarse and insipid under most South American conditions of growth. For centuries there have been cattle, sheep, and poultry in great numbers in most parts of the continent, but their flesh had not the tenderness, the flavor nor the nutritive qualities of meats produced under modern conditions in lands long under cultivation.

Early last century an American, one of the small number of our compatriots who have found the route to South America, was instrumental in getting a number of Merino sheep from Spain into the Pampas, in the hopes of securing a better and heavier clip of wool. Although there was improvement in every flock into which this new blood was taken, the financial outcome of the move was not encouraging. Monetary rewards there finally were, but they came not to him who promoted the improvement but to his successors, when, in later years, the foreign demand arose for more and finer wool. To-day there are probably 40,000,000 sheep affected by this and more recent importations of Merino stock, some of them from the United States, and nearly as many more millions improved by other pure stock imported since the early eighties of last century. Some of the best pure bred sheep of the world are now on the ranches of the Pampas, where the prices of superior sires range from $2,000 to $5,000, in the current coin of the United States, with chief honors about equally divided between the Rambouillet and Lincoln. The former is demanded on ranches distant from the packing houses where fine wool is the aim, and the latter on properties convenient to railway and steamer, with a desire for large carcasses of mutton. All of Europe's chief breeds of sheep are now being tried out intelligently on the Pampas under skilled Old World stockmen, with indications that several besides the Rambouillet and Lincoln will make a worthy place for themselves there.

Sixty or seventy years ago a Briton who had been some time in Argentina engaged in stock farming had a Shorthorn sire sent out from England, chiefly for the purpose of securing better beef for his own table. In this case, as in that of the Merino sheep, the experiment was not satisfactory from an economic standpoint. The progeny of the imported sire were superior to native stock in size and quality of flesh, but there was too little gain in sales to induce further improvement at that time. Later on, however, the monetary importance of high class stock became manifest, leading to an insistent demand for pure bred sires at exorbitant prices, the range having run from $5,000 to $17,000, American money.

The success of the Shorthorn in the clever hands of stockmen of British extraction soon led to the trial of other breeds, with the result that most of those best known in Europe have been imported in considerable numbers. Several of these are apparently adapting themselves marvelously well to the peculiar conditions of Pampas ranching, especially since it has been found that the cereals and cultivated clovers and grasses can be luxuriantly grown there. As a result of the activity in the improvement of cattle during the last fifteen or twenty years there are now tens of thousands of pure bred stock, and millions of cross bred in South America, with the outlook bright for the continuation of the movement until every part of the continent has been lifted above the mediocrity of the past.

As evidence of what has already been done in the improvement of stock, I may refer to one estate in the Pampas, not one of the great estates, either, which has some 35,000 Herefords, 85,000 Shorthorns, 140,000 sheep of a half dozen breeds, and more than 6,000 horses, Thoroughbred, Hackney, Shire, Clyde, and Suffolk Punch; every animal, with hardly an exception pure bred and "home raised."

Occasional efforts have long been made to improve the saddle horses of the continent, all horses until well within the present generation, having been used for riding when used at all, except the insignificant few used in cities. Incidentally, surplus and culls furnished hair, hoofs, hides, and tallow for export. The improvement, however, was at no time general, chiefly because the only markets were local, with a very limited demand for a really good horse. In a few instances coach and draft horses were experimented with but without adequate financial rewards until within the last dozen years. As saddle racing has ever been one of the chief amusements of South Americans it is not surprising that the improvement of running horses received more attention prior to the close of last century than any other class, but even here advance was confined to a small number of the most wealthy urban districts. Thirty or forty years ago a bunch of Morgan horses was taken to the Pampas, but they were not especially profitable to the enthusiastic admirer of the breed who imported them from his native land, although one may to-day discern the Morgan characteristics in the best carriage horses of Buenos Ayres. With present-day means of quickly and safely reaching the markets of the Old World, experiments are being made with the best European breeds of horses. The outlook is very favorable for the utility of a number of these in different parts of the continent from which horses are not barred by the diseases of hot latitudes.

One of the Pampas surprises to the foreigner is the great annual stock show held in the suburbs of Buenos Ayres. About 3,000 cattle of the beef breeds, preponderatingly Shorthorns, are on exhibition, as well as hundreds of sheep, sometimes nearly 4,000 of them, chiefly Rambouillets and Lincolns, with a sprinkling, however, of eight or ten other breeds. There are usually from 600 to 700 horses, less than half a hundred dairy cattle, a score or so of swine, a few pens of poultry, and frequently some dairy and crop exhibits. For example, there was one year a display of Argentine-grown tobacco, cotton, silk, and fruits that would have attracted marked attention in New York or London. There are also vast displays of implements and machines, for the Pampas needs constantly increasing quantities of the best that our inventors and manufacturers can produce. The show is made one of the notable events of the season, attended by high government officials, foreign diplomats, and the leaders of society, for the wealth of most native Argentines, the aristocrats of the country, lies in their lands and live stock.

Late in the sixties of last century some Swiss colonists discovered that some of the Mediterranean wheats would yield fair crops on their Pampas farms. Their success gradually led to experiments with similar seed in other districts, the outcome being equally good, and proving that excellent crops are possible in a territory comprehending many million acres. To-day a part of the Pampas, only

a fraction of the great possible wheat zone of the continent, is exporting millions of bushels of high grade wheat every year, besides producing its own bread.

About the time the possibilities of profitable wheat growing were being proved, an American, a former Kentuckian, having a ranch not far from the Swiss colonists referred to above, planted several acres to corn, using seed from his native State. He harvested a crop that averaged a little more than sixty bushels an acre, indisputable evidence that corn can be grown with profit if the right man is at the plow. The news of this crop was carried on the wings of the wind to all sections of the Pampas, and even beyond, and within a few years scores of other husbandmen demonstrated the general adaptability of Pampas soil and climate to the production of corn of suitable varieties. As a result, millions of bushels of the king of cereals are yearly sent abroad, hardly more than that required for seed being consumed internally.

Another American, a Californian, who went prospecting among the grazing lands of the Pampas, saw in the suburbs of every town and village small plots of the finest alfalfa, but not an acre on any of the ranches. On inquiring why alfalfa was grown only in gardens he was told that it would not thrive on the ranch. Having raised alfalfa all his life he had his opinion of this explanation. Certain, now, of the exceptional adaptability of the Pampas for stock raising, he continued his search, found a frontier property of many thousand acres to his liking, bought it at a few cents an acre, and made speedy preparations to seed a hundred acres to alfalfa. Neighbors advised him that his efforts would be fruitless, for had they not heard all their lives that the ranch would not grow this best of forage plants. His experience with alfalfa in his former home led him to persist in his course despite the forebodings of his new friends. His experiment was brilliantly successful, and to-day he has about 70,000 acres in alfalfa. Moreover, he has yet to turn under the first acre of alfalfa sod.

This experiment, made some forty years ago, induced others to do likewise, the result being that there are now millions of acres of alfalfa on the Pampas. Naturally, for a number of years there was a good deal of doubt concerning the possibility of growing the crop in other districts, so deep-rooted was the belief that it could not be raised in ordinary soil under ordinary farm conditions. But here and there a man was bold enough to go counter to the long established notion, the successful efforts of all these experiments making it certain that every part of the Pampas is unusually well adapted to the production of alfalfa.

Some of the great estates now have over 200,000 acres each in alfalfa, and thousands of smaller ranches each have thousands and tens of thousands of acres. Don't think Smith of Texas, with his little patch of 1,500 acres or Jones of California, with 2,500 acres, is the "alfalfa king" of the world, as some of our papers boastingly proclaim. The "king" is in Argentina, the country which leads the world in the acreage and production of alfalfa, for in the most favored sections of Argentina during mid-season a crop of alfalfa grows in from twenty-two to twenty-seven days, and nine cuttings are made in the year, giving a yield of cured hay ranging from twelve to nearly twenty tons an acre. In the greater part of the country

there are from five to seven cuttings a year, averaging from eight to twelve tons of hay annually per acre. If Clark of Connecticut, with his wonderful knack in growing grass and clover, were in the best part of Argentina he would soon get from thirty to forty tons of alfalfa hay to the acre, for he would have all the advantage of marvelously helpful climate and soil.

Hardly a third of a century ago still another American, a civil engineer who went out to the Pampas to engage in railway construction, saw an unprecedented opening for dairying. Cows swarmed over the plains yet he could get neither milk for the kitchen nor cream for his coffee. The butter set before him was all imported in sealed tins from Europe, and, with the exception of a very unappetizing domestic make, all the cheese was the product of dairies on the far side of the Atlantic. Not a dairy could the engineer "get on track of" anywhere on the continent, so he saved his salary and bided his time to buy a ranch. Having no practical knowledge of dairying when finally in possession of his property he selected Jerseys for his herd, probably the poorest choice that could have been made for the district in which his ranch is situated. But despite this handicap money flowed in from the first milking, leading in a few years to a fortune of several hundred thousand dollars, and also leading in less than two decades to a national dairy industry, exporting millions of pounds of butter and cheese annually.

These Pampas developments in the improvement of livestock, in the production of cereals, and in the conversion of beef cows to dairy purposes, are the foundation of the reports of the wonderful productivity of South American soil and climate, and of the prediction that in another decade the farmers of South America will dominate the markets of the world. If the continent had maintained the gains shown in the exports of farm products from 1885 to 1900, there can be no doubt that before 1920 it would have driven the United States, Canada, Australia, and India out of all European markets, with an equal certainty that our own domestic market would have been flooded with its great crops. But a close study of the conditions under which the development of Pampas agriculture took place shows that these conditions were unusually abnormal, making the gains in the exports of farm products during the period in question equally abnormal. The culmination of this spectacular development was reached in the first years of the present century, from which time there have been only slight gains in the exports of the surplus of the soil from the La Plata countries. Moreover, there is no likelihood that there will ever again be any very considerable gain in the yearly rate of increase in crop production.

Prior to about 1870 the farmers of the Pampas were all ranchmen, as the husbandmen of most other parts of the continent were and still are. Then, there was a vast public domain, looked upon as being almost worthless, free to the stock of whomsoever cared to go beyond the frontier of settlement for pasture. Only the land along the coast and great rivers was thought to be worth buying up for ranch purposes until after the construction of railroads, when settlers slowly followed these new means of transportation. Ranches were unfenced, the great flocks and herds being cared for by mounted men and boys who were hired for a few dollars each per year in addition to a hut, a plot of ground on which to raise the common

vegetables, and fresh meat from the animals they guarded. Every man who worked on the farm was employed about stock in one way or another, and every immigrant farm hand found that the only work in which he could engage was the care of stock.

At this time the population of the Pampas, a territory nearly half as large as the United States, was less than 5,000,000 people, over a quarter of whom lived in the cities and larger towns, and had no connection with farm life. Thus, when it was demonstrated that livestock could be profitably improved, that the cereals would yield excellent returns, and that dairying might be advantageously developed, there were less than 4,000,000 persons, a large proportion of whom were children under fifteen years of age, to do all the farm work undertaken, no matter what its nature. This population, sparse as it was, was considerably in excess of the actual needs of ranching under the method then followed. Families were large, fifteen children in any not exciting special comment, so the women and girls, who were generally expert with spindle, loom, and needle, made the family clothes, and sewed and embroidered as a means of aiding in supplying the necessities of life.

On the discovery that the cereals could be grown, great numbers of men and boys were taken from the saddle to follow the plow, women and girls were also made to do all kinds of work in connection with the cultivated crops, and farm immigrants, with the exception of those skilled in handling stock, found employment as tillers of the soil rather than as hands on the ranch. This change in vocation was made with marvelous rapidity, for by 1900 every woman and girl that could be pressed into service, and every hand that could be taken from the care of cattle and sheep, was engaged in producing wheat, corn and flax. Meanwhile, hundreds of thousands of miles of wire fence were built, not only making it possible to care for stock in accordance with the better methods demanded by the improvement in breeds, and with the minimum of "help," but also, for the first time in Pampas practice, enabling the herdsmen to group animals in suitable classes or grades, instead of having all ages and conditions on each ranch in one great herd.

As long as men could be readily transferred from the pasture to the grain field the increase in the production and export of Pampas cereals could be and was exceedingly rapid, but as soon as the limit of this transferred labor was reached, just so soon was the phenominal gains in crops and exports brought to an end. Extraordinary efforts were made by many land owners to maintain the rate of development by the further use of the wire fence, by the greater use of American labor-saving implements and machines, and especially by constantly increasing the wages of the tillers of the soil. Wages rose in little more than a decade until they were on a par with the pay given in our own country for the same classes of work, and the demands of harvest hands quadrupled, and even quintupled, in the last seven or eight years of the period of development, in the efforts of husbandmen to secure the help necessary to garner their huge fields of ripening grain, which, in some cases, exceeded 30,000 acres each.

The increase in wages, together with other increased expenses, raised very materially the cost of production, so that this, in connection with the frequent losses caused by drought and grasshopper,

made it impossible to secure profitable harvests from a great deal of land that a few years earlier was regarded as satisfactory in its returns. For instance, in 1890 a yield of five bushels of wheat to the acre gave the grower fair profits under the conditions of that time, for each plow could fit the ground for from three hundred to five hundred acres, per season and fifteen hundred bushels at sixty cents a bushel gave the grower some $300 profit. Now, to a family which before this had hardly earned $300 in a lifetime, a five-bushel-an-acre crop on three hundred acres was a small fortune. In 1900 the cost of production had risen to a point that made it necessary to secure at least ten bushels per acre to clear anything over $150 on a three-hundred acre crop. But this profit was less than the wages a harvest hand could earn in the season of about a hundred days, for his wages were then from four to five dollars a day and "found," with work seven days a week. A good many farmers have made crops since 1900 at an actual loss or on a very small margin of profit, for the average yield of wheat for the Pampas as a whole is less than ten bushels an acre, although there are some districts that give more than fifty bushels to the acre in good years.

Then there was witnessed the curious spectacle of tens of thousands of farm laborers crossing the ocean from Mediterranean Europe after harvest in their own lands with sickle and the tramping out of the grain by the hoofs of farm animals, to work a third of a year later with the header and steam thresher in the grain fields of Southern South America. Although the climate was congenial, food was lavishly provided, and wages were from eight to twelve times as high as in the old countries, in the south of Europe, few of these men could be induced to remain on the Pampas to become citizens after the observations and experiences of one or two seasons. Many of them make the trip from the Mediterranean to the La Plata year after year, but having both heard of and seen the "trickery of the natives," they decline to step over the bounds of protection given by the official representatives of their own countries, and return to their native lands at the end of the harvest period.

The boom in stock and grain production quite naturally led to a boom in land values, so that by 1905 farm land in all parts of the Pampas was even dearer, proportionately, than land of the same class in our own Mississippi Valley stock and grain states. If prices had remained reasonable, and if small farms in desirable districts could have been bought, harvest hands and other immigrant farmers would undoubtedly have been tempted to purchase properties and become citizens of the Pampas countries, thus giving a further impetus to their agricultural development. But the good land is largely in possession of the aristocratic native families, and generally they will not sell off farms of a few hundred acres. The general policy is to rent tenants several hundred acres each for a few years, often three, four or five, for the growing of grain, with the proviso that at the end of the term the land is to be seeded to alfalfa. Government lands, usually undesirable on account of their low fertility or because of their difficulty of access, are being sold in small farms. Many of these are fit only for grazing and offer insufficient inducements to ambitious immigrants.

In this brief survey of South American agriculture, we see that the continent has an imperial domain of farm lands waiting to be devel-

oped; that the native aristocratic whites are not disposed to welcome immigrant farmers on favorable conditions; that the advance in Pampas stock and crop production between 1870 and 1905 was phenominal because of phenominal conditions which reached their climax in the latter named year; that since 1905 the increase in production and export has shown only slight gains; and that there is no evidence that the farmers of South America will ever be likely to dominate European or American markets to the detriment of our own husbandmen.

THE COST OF MARKET MILK

Three Ways in Which it May be Reduced by the Producer

By EDWARD VAN ALSTYNE, *Kinderhook, New York*

Mr. President, Ladies and Gentlemen: I think all of us agree that the margin of profit over the cost of production is exceedingly small. In fact in many cases the only real profit is the converting of unsalable or low priced raw material grown on the farm, such as pasture grasses, stalks, hay, etc., into milk. The milk costs in feed, labor and interest on the money invested in the cattle and plant, every cent that is received for it. The crops referred to, marketed through the milk, afford a substantial increase over the cost of production. While dairymen have been called—and with some degree of truth—manure, rather than milk makers, yet when one realizes that a dairy cow will yield eleven tons of solid and liquid excrement in twelve months, worth at current prices for the fertilizer contained in it $2 a ton, allowing that it is all saved, we have a value from the manure of $22, an item not to be despised, as evidenced by the productivity of the farm of the dairyman in comparison with that of his neighbor who is not a stock keeper. These two sources of profit will explain why, in view of the numerous records and cow census of unproductive dairies, few dairymen are sold out by the sheriff. Nevertheless, there should be, over and above these items, a substantial increase direct from the milk, a discussion of which is my chief purpose at this time; but I want first to take a broad view of the situation from the standpoint of the dairyman whose livelihood must come in a greater or less degree from his cows, and who is not satisfied to keep them solely as machines to turn raw material into a finished product, manure makers or for their society. I believe it is wise to look the situation squarely in the face and see what it actually costs to produce a quart of milk under normal conditions.

My own herd are grade Guernseys. The production last year was one thousand pounds a head below the normal, on account of the prolonged drouth, which cut down the yield in spite of supplementary feed. In addition we had three cows go to pieces during the year. The total yield of the three did not equal what one of

them would have done when they were right. There were also five two-year-old heifers with their first calves. All these causes reduced the yield as above. Yet these are things that must always be reckoned with. I am giving facts, not a fancy sketch. Had the milk yield been greater the cost of production a quart would of course, been less. My milk tests five per cent. I consider I could produce ten thousand pounds of three per cent. milk as easily as I could six thousand pounds of five per cent. milk. The former would not ordinarily bring as much and would not furnish the kind of cream my trade requires. We carried during the year twenty-five head of milkers. The account stands as follows:

Purchased grain,	$556 94
Twenty acres pasture,	320 00
Soiling crops,	100 00
One hundred tons of silage,	300 00
Twenty tons of hay,	200 00
Total for feed,	$1,476 94

A trifle more than $59 a head. To this must be added $125 as interest on twenty-five cows at $50 each at 10 per cent. and $365 for labor, making a grand total of $1,966.94. Taking the total yield of milk, 62,500 quarts—2,500 a cow—and dividing the total cost by that sum, we find the milk cost to be .0314 a quart. The feed purchased is just what I paid out in the twelve months. The twenty acres devoted to pasture were helped out by some supplemental feed, such as clover, oats and peas, corn and not less than two pounds of grain daily, besides some after feed on the meadows. I reckon that the pasture would have cut two tons of hay to the acre, or forty tons total. This quality of hay—mixed grasses—would have sold that year for $10 a ton. Taking off $2 a ton for harvesting and marketing leaves $8 net, or $320, which I could have obtained from the pasture land had I devoted it to hay. It seems to me this is the only way to figure pasture. Let it be understood that there is probably no better in the State; in a normal year it will yield fully two tons of cured hay to the acre. On account of the drouth I have this year thrown in some after feed from the meadows.

Most people take about four acres to pasture a cow. The soiling crops are the only ones where I have to do any guessing. To get at the silage is easy. Eight months' feeding, thirty-five pounds a day an animal, makes, approximately, one hundred tons for twenty-five head. On the basis of the price of hay that year I put silage at $3 a ton. This year it would have been $1 a ton higher. Many figure silage at the cost of production. It cost me much less than $3 a ton to produce and put it in the silo. If I had the land that grew the corn in ear corn or potatoes, with a like amount of labor I should have received at least $45 an acre. I know what hay the cows ate, and value it at what it would have sold for. The cost of gathering would be the same in either case. Or, in other words, these products which were fed to the cows, had they been sold—or their equivalent from the land—as they otherwise would have been, would have brought me in cash what I have charged them at. I have put the value of the cows at $50 each. I do not question that they would bring that under the hammer.

I get at the labor in this way: Allowing twenty minutes daily to milk a cow, 292 days in a year, at $1.25 a day, is $365, or one man's wages. This would scarcely be enough for feeding them and cleaning the stables, but much of the labor of feeding would be expended in putting the product fed into market. I will keep a man and team drawing out manure all the year, if some one will furnish it free. While these figures may seem high to some, I am sure they are correct, and the items of interest and labor might well have been put higher. If it costs more than three cents a quart to produce milk, what about those who are only getting that or less?

It must be apparent that they are not getting for their milk according to the cost of producing it. Our sales in cash were $2,357.57. Deducting from this the $1,966.94 leaves only $395.57 real profit to be credited to the dairy. In addition we have the skim milk, not reckoned here at all, and worth not less than $10 a cow. Also our own milk and cream for family use, with which the cows are credited; but it does not appear in the receipts.

As I have intimated, the yield was not large; yet, all will agree, not much below the average of the rank and file of the dairies of the State producing a milk with a much lower fat content. Much of the profit came from my being able to obtain, through being my own manufacturer, a little better than the average price and from the skim milk left on the farm, but had I been obliged to live, buy shoes for the babies, educate them, pay doctor bills, etc., solely from the profit of those cows there would not have been much to reduce the mortgage.

The large producing dairies—of which there are many—would stand little higher in profit, because of a less price received and no by-product left on the farm.

If these statements stand as facts, then the profit is too small. What is the remedy? The response goes up, "A higher price for the milk?" And to this we all say "Amen," with reason and justice. But this is not the first remedy.

Ex-President Smith in a recent address gave the following figures, taken from the Station Herd Record for the years 1905 to 1908. I quote:

"In 1905 wheat bran cost us $17 a ton; gluten feed, $24; cottonseed meal, $28; cornmeal, $22; dried distillers' grains, $27, and oats, 36 cents a bushel.

"In 1906 wheat bran was $22.50 a ton; gluten feed, $28; cottonseed meal, $29; malt sprouts, $18; oats, 40 cents, and corn 56 cents a bushel.

"In 1907 wheat bran was $22 a ton; gluten feed, $29; cottonseed meal, $29.70; malt sprouts, $18.50; oats, 40 cents, and corn, 54 cents a bushel.

"In 1908 wheat bran was $23.50 a ton; gluten feed, $31; cottonseed meal, $33; oats, 50 cents, and corn, 75 cents a bushel."

From these figures it is apparent that in this brief period there has been an advance in the cost of feed of $7 a head, with a constant or equal yield and no advance in price. This $7 is taken from the dairyman's profit. No account here is made of the increased cost of labor and higher value of cows. Should we go back a decade we find these feeds very much lower. The writer has within a shorter period laid them in for much less than the figures given by Mr.

Smith for 1905, and they are higher again this winter. Labor costs full $5 a month more, and cows have advanced one-third in value.

At the best, then, the increased price received—and it has been substantial—leaves the dairymen little if any better off financially than he was before. It is not my purpose to create a hue and cry for better prices, although from the foregoing it must be apparent that we need and must eventually have them. The sooner the consuming public realizes these facts the better for us, and I have cited them hoping that they may come to its notice, at least in some slight degree, and help to controvert the columns of matter, editorial and otherwise, that have lately appeared in the press of New York City howling about the Milk Trust and the opulent dairymen, who are waxing fat on the products accruing from the advance of one cent a quart to the consumer for his milk, one of the cheapest and most nourishing articles of food he is placing on his table; and that the dairyman, too, may stop and consider whether he is getting what he should from his cows. The trouble has been, and is now, that men are waiting for an advance in price to help them, rather than exercise themselves in doing what they can within themselves to decrease the cost of production. My observation has been that the man who folds his hands and sits on the fence and howls about existing conditions and fails to do the first work—such as he and he only can do—will howl until Gabriel blows his trumpet, for he will be in no condition to receive the benefits when they do come. When, under Nehemiah, the walls of Jerusalem were rebuilt by a weak people beset with foes, the task was accomplished by each man building over against his own house. I well remember twenty years ago, when milk would scarcely average $1 a hundredweight annually, dairymen were sending up a howl of no profit, and longing for the day of higher prices. Well, this winter the price is double, and the howl about his non-paying dairy, like the poor, is still with us, except from those whom the old man with the scythe has gathered in—let us hope to the land of milk—and money. At the same time, men made money from their cows then, as they do now.

What are the requisites? None that I know are new. I can but emphasize, for the most part, some very old truths.

THE BETTER COW

Long has this been tried, and although substantial progress has been made, yet here is the greatest leak. Too many cows—like Pharaoh's lean kine—are eating up the yield of the profitable ones.

One reason why there is not a more substantial advance in the price of milk is that we are making just a little too much. The cut in price of five cents a hundredweight in the spring of 1909 by the Bordens, with labor so high and feed higher than the year before, was only possible because there was plenty of milk in sight. The elimination of the least profitable cows would reduce the quantity put on the market, and thus enhance the price on a basis which always works—that of supply and demand—and those left will produce a profit worth while. In the report of Mr. Smith referred to, his best producing cow made milk at a cost for food of .4817 a hundredweight; the poorest at a cost of 1.227 a hundredweight; .102 as against .261 fat a pound, .118 as against .224. In all the years

the variation was as great. While there is a greater or less number of good cows in every dairy, they are continually going the way of all the earth. Where are those coming from to take their place? Right here I want to call attention to the scarcity of milch cows. When one stops to think of the increased amount of milk each year, which is diverted from manufacture in butter and cheese and sold as crude milk and considers that milk selling usually means no more calves raised, we understand why this scarcity. With a milk train starting from the St. Lawrence and drawing milk from hauling distance on either side until it reaches the Mohawk, whence it goes through the valley of the Hudson to Greater New York, there is left in its wake an army of farmers who are annually in the market buying cows. Men who formerly raised their own stock and had a surplus to sell. This process is repeated all along the southern tier, as well as in the Catskill district and through New England, Pennsylvania and New Jersey, as I can personally testify. When one speaks to these men of the importance of raising calves of the right sort, as the only sure way to get these good cows, he is met with the objection, "We sell our milk, and consequently cannot raise our calves." I contend that the only sure way to get this good cow economically is to raise her, and to this end I would have you who are still selling the milk to the manufacturer and retaining the by-product think more than twice before you dispose of your entire product lured by the extra ten cents a hundredweight in cash. Further, I am also sure that it will pay the milk seller to raise his own stock, although he must needs feed them whole milk for the first four or five weeks. A calf worth raising is well worth this outlay. Incidentally, it means better stock, for a man will not hesitate to so feed a pure bred or high grade calf, which is bound to have a value from its youth up, when it is an open question if it will pay to grow an inferior one, even on skim milk. This emphasizes the value and importance of the mature pure bred bull. Lacking such parentage, ninety-nine out of every one hundred calves will not pay to raise to make milch cows under any circumstances. The time is when there is a good business in raising good milch cows to sell.

FEED

As I see it, the next important factor in economical production is the feed. If the cows are allowed to become reduced in flesh at any time because of insufficient or innutritious feed they cannot possibly produce the full quantity they otherwise would be capable of doing. Too often during the summer the pasture is such that even with supplemental green foods—even though the milk flow is kept up—the cows lose flesh. I am satisfied that a small amount of grain in such cases will be in the line of economy, even though, as is usually the case, the increased milk scarcely pays for the feed. The cow will produce enough more when she freshens to more than compensate, and will require less food to keep her than if she must be built up as well as sustained. Again, when dry, during the last two months of pregnancy, too often the protein food is withheld that she needs to build her calf, consequently she freshens without filling her udder, is thin, and again fails in what she would be capable of doing had she some reserve to draw on.

We are spending too much of the proceeds of our milk for purchased grain. In the desire to produce a large quantity we are feeding for production rather than for profit.

If one will note the character of the feeds most in evidence through the dairy sections he cannot fail to observe that by far the largest part of them are the "mixed feeds," comparatively low in protein—the thing that one most usually needs to buy—and high in fibre, of which he has a surplus at home. The straight by-products of the mills, breweries, malt houses, starch factories, cottonseed and linseed oil mills are neglected, because the price a ton is higher. Time forbids that I should particularize or go into a dissertation on feeding, but I am sure I have touched on one of the greatest sources of loss in milk producing. We have come to the time when we would better grow on the farm more of the feeds our cows require, insuring their purity and nutrition and production at first cost—silage, more clover and alfalfa, oats and peas and barley, both as fodder and grain, not forgetting that the early cut hay will take the place of a pound daily a head of grain. Were the number of cows reduced, as suggested above more and better feeds could then be produced on the farm to more nearly sustain those which remain.

SANITATION

Last more attention to matters pertaining to sanitation make for economical milk production. On this point, particularly in the milk producing sections, there has been a strife between the producer and the receiver of milk. My brethren, these things ought not so to be. As is always the case, there is fault on both sides, and it is because of a desire to help adjust this most important matter that I disgress a bit from this, bearing on economical production. I think the handler has been most to blame, although with no bad intent on his part, but he has allowed—or been forced to allow—a set of men to go out to inspect the dairies furnishing him milk who have no practical knowledge of dairy matters, and whose main thought is to draw their pay and exercise a little brief authority. The farmer despises such a man, and cannot be blamed if inclined to connect them with the business end of a good dog. So long as the so-called inspection is done by men of this class no progress will be made, particularly when they insist on improvements that require a large cash outlay, and at the same time the receiver of milk cuts the price a half a cent a quart, as has been done.

THE PROTEIN REQUIREMENTS OF THE DAIRY COW

By PROF. WELLS W. COOKE, *Washington, D. C.*

Few problems of livestock husbandry have received more attention than this one of the question of how much protein is required by the dairy cow. In 1864, Wolff published his standard ration for the dairy cow which contained 160 pounds of total digestible

material and 2.5 pounds of digestible protein. For many years this was accepted as the standard and has probably been used more than all other standards combined. The great corn producing states of the Union, when they turned their attention to dairying, found that under their conditions protein was the most expensive ingredient of the ration and many experiments were conducted for the purpose of ascertaining how much this daily allowance of protein could be reduced, without decreasing the milk flow, or diminishing the protein in the animal's body. Woll collated the ration of many of the best dairymen of the United States, and as a result of his investigation, he concluded that the dairy cow could do well on a ration containing 17.3 pounds total digestible of which only 2.15 is protein. This last standard—called the Wisconsin standard—has been advocated for the use of those who can raise starch cheaply, but would have to buy the protein if they fed it heavily. Both the above rations are faulty in that, they are supposed to be the proper rations for a medium sized cow giving a fair flow of milk, but they make no allowance for variations in size or milk flow. In 1897, Lehman published his standards for the dairy cow, in which he varied the ration according to the amount of milk produced. His ration for a cow giving twenty-two pounds of milk daily contains 16.7 pounds of total digestible of which 2.5 pounds are digestible protein, thus agreeing very closely with Wolff's published thirty years earlier.

The latest standard ration for the dairy cow is that proposed by Dr. Armsby of the Pennsylvania Agricultural Experiment Station. His ration is obtained in the following manner: It is known that a thousand pound farrow cow that is not producing milk will keep up the protein need of the body on a daily allowance of 0.5 pounds of protein. A pound of milk contains about 0.3 pounds of protein. Dr. Armsby believes that an addition to the maintenance ration of 0.05 pounds protein for each pound of milk produced will be amply sufficient for the needs of the cow. On this basis the standard ration for a cow giving twenty-two pounds of milk daily would contain 15.2 pounds of total digestible material of which only 1.6 pounds would be digestible protein. It is thus seen that the various standards differ widely—the two German standards being the highest in protein and Dr. Armsby's the lowest.

Several years ago I had occasion to study the rations fed by many dairymen in Vermont. I found that the dairy cows near the towns, whose milk was sold in town for use as whole milk, were of a better grade than the average, and were fed more protein than was called for even by the German standard. Three years ago in the best dairy districts of New York State I found the same state of affairs. In each case the rations fed were the result of long years of careful feeding with reference to net profits. These dairymen had become convinced that the extra cost of the heavy feeding was more than counterbalanced by the increased yield of milk. On the other hand whenever I examined the rations fed on dairy farms that were remote from the railroad and where the milk was used for the production of butter or cheese I found a relatively small amount of protein in the daily ration and a much smaller average milk yield per cow per year. On such farms, the bringing in of grain or of by-products rich in protein was expensive, and experience had

seemed to prove to these dairymen that their net profits were larger when they fed only such grain and coarse fodder as they could grow on the farm.

The above experiences offer strong presumptive evidence, that (leaving out of account the question of price) a ration rich in protein is better adapted for milk production, than one poorer in this element.

In most of the states east of the plains, protein is expensive, and in all my earlier feeding of dairy cows, the important question was, how little protein can a cow use and still do her best. Then I went to Colorado and fed dairy cows on the basis of $2.50 per ton for the best alfalfa hay, $9.00 per ton for wheat bran, and $22.00 a ton for corn. The protein problem was entirely reversed. Protein was about the cheapest food ingredient, and the question became, not how little must a cow have, but how much can she consume without injury. For a whole winter I fed ten cows on a ration consisting of four pounds of bran, four pounds of linseed meal and all the first class alfalfa hay they would eat. Each of these feeds is rich in protein and the total ration contained much more than the real needs of the cow. These cows were somewhat above the average in size and probably ate about twenty-five pounds of alfalfa hay per day per head. A ration of four pounds of bran, four pounds of linseed meal and twenty-five pounds of alfalfa hay would contain 4.6 pounds of protein as compared with the 2.5 pounds daily in the richest German ration. These cows averaged about twenty pounds of milk per day, which would take out 0.8 pounds of protein, leaving 3.8 pounds of protein for the use of the body of the cow as compared with the 1.7 pounds in the German standard and with the only 0.5 pounds of protein that seems to be required to renew the actual daily breaking down of the tissues of the body. It is evident that these cows received much more protein than they needed, yet this extra protein produced no bad effect, the cows kept in excellent health, they seemed to produce the milk more easily and held out in milk flow better than under the previous feeding with a ration richer in carbohydrates.

English steer feeders found out long ago that their animals made faster gains when they were fed an excess of protein and it is customary in England to feed steers nearly twice as much protein as they really need. The excess of burned up in the body and has the same use and food value as an equal weight of carbohydrates.

Taking it for granted then that a liberal amount of protein is advantageous to the dairy cow, the practical question is, can the dairyman at present prices of feed and products afford to furnish his cows an excess of protein. No single answer can be given that will apply to all farms in Pennsylvania, but some facts will be presented that seem to indicate that many Pennsylvania dairymen would receive an increased profit by using more protein than is called for in the richest standard ration. During the last few years the prices of grains and mill products have increased enormously, but the increase has not been proportional to the protein content and at the present time the market price of a dairy food bears little or no relation to the per cent. of protein it contains. Corn and bran have been the standard grain feed of the dairyman. Let us see how these compare in their composition and price with some other dairy foods.

	Pounds digestible in 100 pounds.	Price per 100 pounds.	Cost per pound digestible, cents.	Per cent. of digestible protein.
Bran,	57	$1 25	2.10	11
Corn,	81	1 25	1.50	7
Oats,,	66	1 90	3.00	9
Gluten feed,	78	1 65	2.10	20
Ajax,	80	1 55	1.95	22
Linseed meal,	74	1 90	2.60	28
Cottonseed meal,	81	1 80	2.20	36

Evidently the foods rich in protein do not sell at a correspondingly higher price and a dollar invested in some of the oil meals for instance, will buy almost as many pounds of digestible material as it would spent for bran and will at the same time secure a much larger amount of digestible protein.

A grain ration of equal parts by weight of wheat bran and cornmeal is a first class feed for the dairy cow and has probably been used more than any other one grain mixture. Years ago when bran was cheap, this was an economical ration, but under the present high prices it is possible to make a cheap mixture. A ration of four pounds of bran and four pounds of corn meal would contain:

	Total digestible, pounds.	Digestible protein, pounds.	Cost.	Fertilizing value of the nitrogen.
Four pounds bran,	2.28	0.44	$0 05	$0.0195
Four pounds corn,	3.24	0.28	0 05	0.0125
Total,	5.52	0.72	$0 10	$0.0320

If the four pounds of corn are replaced by two pounds of gluten feed and two pounds of cottonseed meal, and if three pounds of Ajax are used in the place of three pounds of the bran, the ration will be considerably improved at only a slight difference in expense.

	Total digestible, pounds.	Digestible protein, pounds.	Cost.	Fertilizing value of the nitrogen.
Two pounds gluten feed,	1.56	0.40	$0.033	$0.0185
Two pounds cottonseed meal,	1.62	0.72	0.036	0.0337
Three pounds Ajax,	2.40	0.66	0.046	0.0352
One pound bran,	0.57	0.11	0.012	0.0049
Total,	6.15	1.89	$0.127	$0.0923

It will be noticed that the total food value, *i. e.*, the total digestible material is somewhat increased from 5.52 pounds to 6.15 pounds, and that there is not much difference in cost for each pound of digestible food. The first ration furnishes 5.52 pounds of digestible material for ten cents or 1.8 cents for each pound digestible. The second ration contains 6.15 pounds digestible at a total cost of 12.7 cents or 2.1 cents for each pound of digestible food. The most striking difference in the two rations is with reference to the amount of protein they contain. Here the figures are 0.72 pounds for the first ration as compared with 1.89 pounds in the second. In other words the amount of digestible protein in the ration has been much more than doubled, with only a slight increase in the cost of the whole ration and of course a large decrease in the cost of each pound of digestible protein.

It is evident from the figures given that the present market prices bear little or no relation to the amount of protein contained in the feed and the obvious lesson is that in buying feeds for the dairy cow those should be selected that furnish the largest amount of protein at a reasonable price.

The fertilizer side of heavy protein feeding should not be ignored. During the last few years the market price of nitrogen has risen until now in mixed goods it costs not less than twenty-five cents a pound and probably in most cases it exceeds thirty cents.

The richer the food in protein, the richer the manure in nitrogen, and it is much cheaper to buy nitrogen in feed and apply it to the fields through stable manure, than to buy it in the form of commercial fertilizer.

	Pounds of nitrogen per ton.	Value of nitrogen per ton at 25 cents per pound.
Bran,	30	30 75
Corn,	25	6 25
Oats,	29	7 25
Gluten feed,	74	18 50
Ajax,	94	23 50
Linseed meal,	106	26 50
Cottonseed meal,	135	33 75

The fertilizing value of cottonseed meal is equal to its market price and although the dairyman cannot expect to recover in the manure all of the nitrogen of the feed, he ought to save four-fifths of it. Under present prices and conditions it is much better for the dairyman to spend his fertilizer money for the cheaper phosphoric acid and potash and obtain the needed nitrogen by the purchase of concentrated feeds.

Most writers and speakers say that the full standard ration for the dairy cow should be fed when she is in full flow of milk and that later on as the milk flow decreases the amount of grain should be correspondingly lessened. My practice has been different. I have fed a maximum of grain to the cows fresh in milk and have reduced this only in slight amount until the cows became dry. During the latter part of the milking period the food of the cow must supply the ingredients for the milk produced and must also furnish everything necessary for the growth of the calf. No exact statement can be made as to how much extra protein the cow must consume for the needs of the calf, but it is probably not far out of the way to say that the growth of the calf to the time of its birth requires as much food as would be needed for the production of an extra thousand pounds of milk. But I believe in heavy grain feeding to the cow in the latter part of the lactation period, for still another reason. It seems to have been pretty definitely settled that a cow gives more milk and makes more butter in a year, the fatter she is at the time of calving. Now that milk-fever has ceased to be a menace, no dairyman can afford to have his cows in poor flesh at calving-time.

Summary—Use such highly nitrogenous grains in the dairy ration, that the cow is always receiving an excess of digestible protein. Continue this heavy protein feeding throughout the milking period.

COW TESTING ASSOCIATIONS

By HELMER RABILD, *Washington, D. C.*

The subject of cow testing associations is one which is very dear to my heart, because I have seen them in operation, and know what great things they have accomplished for dairymen in the old world.

As many of you know, it was not my good fortune to be born under the Stars and Stripes. I was born and raised in Denmark, that little two-by-four country across the Atlantic Ocean, which has an area of 15,000 square miles, and a population of two and a half millions of people.

I should like to go back in the history of Denmark a few years, in order to show the tremendous lot of good the cow testing associations have accomplished for its farmers and if I should say anything about the dairymen of that country which you might construe as a boast, I would ask you not to take it so, because no one can be more loyal to the country of his adoption than I am to this country. I speak of Denmark and the progress they have made because I am intimately familiar with it, have contributed my little mite towards it, and because I believe we can find in the history of this progress something from which we can draw a lesson.

In 1848-49 and 50, Denmark was involved in a war. Although this war was declared a victory for the Danish weapon, it drew very heavily on the resources of the country. A large number of its best men lost their lives in the struggle, and the expenses of the war were yet to be paid. The nation was slowly recuperating from the effects of the war, when in 1864 it was forced into a new war. This war it lost, and with it the dearest possession Denmark ever had, Schleswig-Holstein. The expenses of carrying on the war were still unpaid, and the national debt, to use an expression often heard in those days "extended up over the chimney tops." This enormous debt had to be paid by taxation of the resources of the country. The resources of Denmark were very limited, there were no forests, no mines, no industries, and no shipping, and the only resource which could be taxed was the soil; in other words, the farmers had to foot the bill. The country was on the verge of bankruptcy. The rate of interest was in 1872 three and one-half per cent. higher than it was on the English burse. The taxes went sky-high, and the system of agriculture carried on on the farm was not good enough so that it could create funds enough to meet these taxes. The Danish farmer had for many years been engaged in the beef business, and shipped his beef to the English market; but just about at this time the English farmer made up his mind that he might as well produce his own beef and keep that money in his own country, and so he asked Parliament to restrict the importation of Danish beef. This was done through Quarantine regulations, and the Danish

farmer lost his last resource, the beef business. Many of them despaired of ever making enough money to meet the demands of the heavy taxation on their high priced land, and a large number left their farms and homes to be sold at sheriff sale to come to this country and try to make a new home for themselves and their families. Some, however, for reasons sentimental or otherwise, did not want to leave the country of their birth; they would rather starve there than live in plenty anywhere else, and these were the ones who have made Denmark the dairy country it is to-day.

The cows that were on the farms in Denmark at that time were principally beef cows. The average production of butter per cow in 1884, just twenty-five years ago, was only 112 pounds of butter per cow in a year. The Danish farmer soon realized that if he wanted to make any profit in dairying which, at that time, gave promise of staple markets for butter at fair prices, it was necessary that he should develop a better producing strain of cows, and he started in to select from his native cows, the individuals which showed that they possessed dairy quality, bred them to good sires, and raised their female progeny, and in this way he has succeeded in raising the average production per cow until in 1908 was 224 pounds of butter per cow a year. He has virtually changed the beef breed into a dairy breed by selection and good breeding. Along with this came a great improvement in the prosperity of the country, which in 1872 was on the verge of bankruptcy, and to-day it stands as second richest nation of the world in per capita wealth.

Now, ladies and gentlemen, that is what cow testing associations and dairying have accomplished for the Danish farmer, and it explains why I am enthusiastic about these associations. The average production of butter per cow in this country to-day is, according to the United States census of 1900, only 142 pounds of butter per cow in a year. If we figure that this butter sells for twenty-five cents per pound, it means that the average cow brings in $35.50 in a year. Now, if it does not cost more than this amount for feed, the dairymen can just come out even; and if we figure that the skim milk, the calf, and the manure will offset the cost in taking care of the cow, the farmer has simply sold his feed to that cow at the market price, and has not made any profit on his dairy operations.

I do not see any reason why we should not be able to double this production, as the Danish dairymen have done, for we have a better climate, better feed, better cows to start with and just as good men. But if we do, I think we must follow the same lines, and perhaps adopt the same system that the Danish farmers did.

That is the reason why the Dairy Division of the Department of Agriculture has interested itself in the organization of cow testing associations, and have experimented with them in this country until we have learned that with some modification they can be successfully operated under our conditions.

We have in this country to-day fifty-two cow testing associations, and there is promise of a good many more. A cow testing association, to be brief, is simply an organization of twenty-six farmers which club together for the purpose of improving the profits from their dairy operations, through selection of the individuals in herds which show special dairy tendencies. Such an association employs one man who goes from place to place once a month among the mem-

bers. He makes a visit to each place once a month, and obtains data from which he can judge the individuality of each cow in the herd. He remains twenty-four hours on each farm, and while he is there he takes part in the feeding, and weighs the feed each cow consumes. He also weighs the amount of milk each cow produces and he tests the richness of this milk with a Babcock tester. He does this night and morning at regular intervals twelve times during a year. And in this way he learns how much milk and butter fat each cow produces in a year, how much feed she consumes, and how much it costs to keep her. The farmer is furnished a complete record of each individual in his herd, and with this as a basis is enabled intelligently to select those for breeding purposes, which show the highest development of dairying tendencies. And first of all he learns which ones of his cows do not produce enough milk and butter fat to pay for the feed they consume. He learns to know his "star boarders." You know a "star boarder" is one who never misses a meal, and never pays a cent, and we have entirely too many of that class of "star boarders" in our herds. If we had not, the average production would be a great deal higher than it is to-day.

I have on this chart ten years record of one herd, and it shows what can be accomplished through membership in a cow testing association.

Herd B, Owned by Aug. Kinch, Beltaberga, Sweden

Year.	Average number of cows.	Average feed units per cow.	Pounds milk per cow.	Average test.	Pounds butter per cow.	100 Feed Units Gave.		Food cost of one pound butter.
						Pounds milk.	Pounds butter.	
First,	70	2,421	7,320	3.05	245	302	10.1	19.8
Second,	28	2,695	7,905	3.13	272	293	10.1	19.8
Third,	46	2,566	9,003	3.20	317	350	12.3	16.2
Fourth,	55	2,507	9,984	3.18	350	398	13.9	14.3
Fifth,	61	2,587	10,584	3.22	376	407	14.5	13.8
Sixth,	64	2,743	11,236	3.22	399	409	14.5	13.7
Seventh,	71	3,035	11,333	3.21	401	372	13.2	15.1
Eighth,	79	3,111	11,486	3.18	403	369	13.0	15.4
Ninth,	77	3,075	11,023	3.17	385	358	12.5	16.0
Tenth,	79	3,051	11,399	3.34	421	374	13.8	14.5
Increase,	------	630	4,079	.29	176	72	3.7	-5.3

You will notice that Mr. Kinch had seventy cows to begin with, when he joined the association. After being a member one year, he learned that only twenty-eight of them were good enough so as to be used for breeding purposes, and so he promptly sold off the balance of the herd. He bred these twenty-eight cows to sires whose dams and granddams showed superior dairy qualities, and raised their heifer calves. He had some heifer calves from those twenty-eight cows on hand which were added to the herd so that in the third year he had forty-six cows. This number kept increasing until in

the seventh year he had one more cow than he started with. In the tenth year he had seventy-nine cows, and the average production of the herd had been increased 4,079 pounds of milk per cow. The increase in butter per cow was 176 pounds. It took 630 more feed units per cow to produce this increased amount, but giving the feed units a value of two cents per unit, and the butter a value of thirty cents per pound, he had increased the profit per cow from seventy cows from $25.08 to $65.28. This means that in the tenth year he received $2,814 more from the same number of cows than he did when he started as a member of the cow testing association.

Assuming that he could apply the income from his herd to pay off a mortgage on the farm, with a herd like the one he owned the first year he could pay off a $20,000 mortgage in seventeen years; while, with a herd like the one he had the tenth year, this mortgage could be paid off in five and one-fourth years.

So, you see the value of that part of his life which he puts into the dairy business has been material increased.

I see no reason why an American Dairyman should not be able to do equally as well. It seems to me that it is only a matter of getting started.

On this second chart we find the average of the Lundatrakten's Cow Testing Association for ten years.

Lundatrakten's Cow-Testing Association, Sweden

Year.	Average number feed units per cow.	Average number pounds milk per cow.	Average test.	Average number pounds butter per cow.	100 Feed Units Gave.	
					Pounds milk.	Pounds butter.
First,	2,586	6,890	3.11	326	266	9.1
Second,	2,458	6,582	3.11	225	268	9.1
Third,	2,501	7,357	3.16	256	294	10.2
Fourth,	2,418	7,692	3.17	268	319	11.1
Fifth,	2,281	7,653	3.04	256	336	11.2
Sixth,	2,443	8,268	3.04	277	338	11.3
Seventh,	2,603	9,155	3.05	307	352	11.8
Eighth,	2,648	9,338	3.15	324	353	12.3
Ninth,	2,535	9,183	3.15	319	355	12.3
Tenth,	2,751	10,064	3.12	345	366	12.6
Increase,	165	3,174	.01	109	100	3.5

There were 639 cows in this association, and figuring the feed units at the cost price of two cents per unit and the butter at its selling value of thirty cents per pound, 639 cows in the tenth year returned $18,240 more than they did during the first year they were in the cow testing association. There has been a continual increase in the amount of production, as well as in the economy of production.

Knowing these splendid increases which the cow testing work has accomplished, you will understand why I am enthusiastic about it.

In stimulating the interest in the work, the Dairy Division is cooperating with State authorities. In this State Prof. Van Norman

is much interested in the work, and through his efforts two cow testing associations have been organized in the State; one at State College, and one at Chadd's Ford.

The Dairy Division, as I said before, is very much interested in this work, because of the results which have followed it in places where it has been tried. It stimulates interest in better dairying; not only in the development of better cows, but in better feeding, better housing and better care of the animals, better care of the product, it fosters community spirit, because it is co-operative, and it stimulates interest in the work on the farm, and that is what is needed most of all in a great many cases.

I have gone over this rather hurriedly, because the time is short, but if you know of any communities where there are twenty-six men who would be willing to pay $1.00 per cow per year toward defraying the expenses connected with this work, and let it be said in passing that this dollar goes to paying the salary of the man, the Dairy Division shall be glad to assist you through Prof. Van Norman in getting an association organized. We will also, as far as our facilities permit, assist the association by furnishing books and blanks for the record work until such time as the State may make an appropriation for providing this material.

THE REQUISITES OF A GOOD INSTITUTE LECTURER

By PROF. EDWIN VAN ALSTYNE, *Kinderhook, N. Y.*

I trust that none of you will think it presumptious, for the stranger within your gate, to have selected the above topic. Should you consider me as one, "sitting in the seat of the scornful," or like the colored brother, who at a funeral of one of his race, pushed aside the wailing mourners and said, "If you wish to see grief, let me come," I should repent in sack cloth and ashes at having even thought of presenting the suggestion that follows: For while your innate courtesy would prevent any audible comments coming to my ears, I am sure I could read in your faces the comment, "What does this babbler say?" or, "Physician, heal thyself." Rather consider me as one among you who serveth.

The subject matter of this paper I have been incubating on for about a year, to deliver at the request of Commissioner Pearson, before my fellow-workers in New York. Not because "I have by any means attained, or am already perfect," but that a training under such men as J. S. Woodward, Prof. I. P. Roberts, Col. F. D. Curtis, G. T. Powell, and an experience and association of over twenty years, with some of the best men in my own State, as well as those whom we are all delighted to honor, for their work's sake, from the broad field of our own country, and our Canadian cousins across the border, and not least among the number some of your own Pennsylvania men with whom I have worked both at home and abroad

and to all of whom I am debtor, has given me opportunities to mark the strong points as well as observe and depreciate the weak ones. To the end that I might speak a word, that would help some of the younger men, that they in their day—which is right upon them, for we of the old guard, in less than a decade will have put off the harness—may do better work than we ever did. For the Institutes of the future, with a trained class of hearers will demand a class of instructors far beyond those who have gone before. We have laid the foundation but it is for you to rear the superstructure. I was speaking to our ex-Director Smith at one time about the men whom we had tried and apparently found wanting, and I said, "Perhaps we have been too critical. Think what we were when we started." He replied, "You forget, Van, that the people took from us twenty years ago,—because they knew no better,—what they will not tolerate to-day." Surely he was right, for I would indeed pity the audience as well as the speaker, who had to submit to what we were able to give in those formative days.

Therefore, anything that I may say which may seem critical, is very likely a criticism that I have sometime had laid at my own door. All is spoken in the spirit of brotherly kindness, if you will so receive it and if on my return, or in the years to come, I can feel that any word spoken here to-day, has helped any one of you to do more efficient work, and to have higher standards, and keener conceptions of your practice and opportunities, I shall feel well repaid. For nothing am I more grateful than for the words spoken in season by some of those early associates, to whom I have referred. In the quiet of our rooms, after the day was done, calling attention to a loose or incorrect statement, a faulty or weak presentation, an unfortunate illustration or story, or some mannerism, that persisted in, would have been fixed. Of course some of them hurt at the time—for like all young men, I naturally thought I was a Bonargares, but what measure of success that has come to me I attribute largely, to the pruning knife, which they so nicely and so kindly used, and the high standard they set up. For they were giants in those days and their high standards I have never seen surpassed.

With all this in mind I had the boldness to give Director Martin the above, as one of the subjects upon which I might talk. Yet I was after all appalled, when I saw that he had selected it. He having so selected, and being with you in the flesh, I shall therefore give you my message, in faith—that it may be received with kindness,—in hope that it may be of profit,—in charity that thinks no evil,—and with fidelity to what I feel within me to be the truth.

THE MAN

There are many things required of a good institute instructor; but first and above all must be *the man*. He may be, should be, many things, but all else will be as sounding brass and tinkling cymbals, except he is a success at home. By success I do not mean, he must have attained a competency. For many a man has made money, who is far from a success, but that he must be actually doing the things of which he speaks and doing them in such a way that he can speak to his own neighbors with the same force with which he speaks to strangers. This I make the first requisite of any man or woman

that comes into my corps. When a conductor can introduce a speaker with a guarantee that he knows that he is doing that of which he speaks he has done much to insure the man a respectful hearing. Last winter I brought a new man into my force. He is a comparatively poor man: but because he has one of the best cared for young orchards in New York, an object lesson to the neighborhood, and has made a success with poultry, vegetables and small fruits, I was not opposed to trying him out, knowing that if he failed to make good as an instructor he would command respect for what he was doing; for no man can get very far away from his reputation at home. I have known some of the ablest men on the platform, who were favorites with their audiences, for the time being, whose farming was a by-word and a hissing to their neighbors. And "their works do follow them," for at a later visit no one had any faith in even the good true things he said; more than that, it marred the effect and effort of any other man in that place, perhaps for years to come. A case in point: Not long ago I followed a man who is exceedingly bright, well educated and I am told an excellent instructor. I knew that he had had little practical experience on the farm, and what he had, was not much to his credit. He was on this account eliminated from the force. The place had an excellent reputation as a good institute town. There were some local conditions which had rather reduced the attendance: but not enough, it seemed to me, to account for the falling off from the record of the previous year, and the lack of keen interest which makes a first class institute. I had with me a most excellent force, each one of whom I could swear by as doers, and each well suited to the needs of that community. After the meeting was over, a gentleman said to one of us, "You gave us different doctrine from the man we had a year ago." After some questioning I found what had been said, and then drew out the comment, "We inquired about him and found he had made a failure of school teaching, farming, and everything he had undertaken, and then went to work for the State." I asked, "Did that have anything to do with the reduced attendance and interest?" He replied, "Yes, I am sorry to say it did." Comment is unnecessary. I would not for the moment imply that any man who is a success in the thing of which he speaks is a good institute man. Far from it.

ABILITY TO TEACH

A man must be apt to teach, but I insist he must first be a success. We have, as have you, scores of good men, patterns in their communities. Some of them are not able or willing to go from home, so no matter what their ability they are not to be reckoned with. Others are able, some are willing, and some are anxious to go, but they lack the training, or the ability to so express themselves, as to be of any benefit to their hearers.

I have known many such, and they call forth my deepest sympathy and regret. With such I would bear long in the hope that they might, by environment and association improve; but an experienced man can, I think, very quickly tell whether such a man has the power in himself to make him a good teacher. One case will illustrate this: There is a young man in my state whose work in a certain line of farm improvement and crop growing, I have watched

for several years at long range. He is an eminent success. Because of this he was asked to do some lecturing; in fact he did practically a whole winter's work. Needing some one in his particular line, and knowing he had the first requisite and feeling the experience he had would warrant it, in an unguarded moment I engaged him for three months. Later I was told that he was not a success as a teacher, but feeling that I could help so worthy a man, who had in him so much good sense, by timely counsel, I started in with high hopes. At the start I saw he lacked preparation, and I suggested an outline, which suggestion he gladly received, but alas, the longer I had him the worse he got. He wandered from Dan to Bersheeba and when he had occupied more than his allotted time had often not touched upon the very things the people wanted. I never had a man get on my nerves so before. The truth was that he could do, and did do, well the things that he had undertaken on the farm, but his mental processes were too slow ever to be a teacher. I was ready to sing the Doxology, when business matters compelled him to retire from the force. The pity of it was that he was a likable fellow and so far as he knew, he tried hard. It is the audience I am always thinking of. With another man, an eminent success in his line, but so slow and sleepy that after we had him out a week, I had a note sent up from the floor reading, "For heaven's sake stop that insect and save the audience."

Ability to teach is to a great degree a gift, but there are those things which will materially assist if one will heed them. Of these I will speak later on.

A GOOD MORAL CHARACTER

Though a man may have the two requisites mentioned, yet he falls far short of the full stature of a good institute instructor if he is not a man of good morals.

Right here I want to stop and bear testimony to the fact, that with very few exceptions, the institute men with whom I have worked—and they are many—have been Christian gentlemen. The purpose of the institute is to teach agriculture, not to discuss politics, finance or religion. But the institute that has not left a little higher standard of morals and ethics in a community has not done all it ought, and might. After all the main thing back of a man's teaching, is what he *is*. Too often in rural communities the moral standards are none too high, as evidenced by the lewdness and profanity which abounds in ordinary conversation. Often an evidence of a deficient vocabulary and a lack of knowledge—that does not indicate a high type of manliness. Or the patronage received by local saloons, or—by courtesy—hotels. I do not mean to say that this is confined to farmers. It is considered part of the stock in trade of a local minister to advise against these things, but when there come into their midst, farmers whose hands are calloused, and who are familiar with farm work, which mark them as men of like passions with themselves, with good red blood in their veins who abstain from such things; and as opportunity offers—without ostentation—take a stand for rightiousness, and are not ashamed to pay tribute, and own allegiance to the church, they leave an impress not soon forgotten. All of which dignifies agriculture. Unless the farmer can be made a better—broader man, it will, in the last

analysis, avail little, simply to make him a better farmer. The institute instructor who between sessions, practices at the bar, or listens to, or worse still, tells obscene stories, or who, by his conduct in any way, does that which is contrary to good morals, may provoke the laugh, and think himself a good fellow, but be sure he will lose cast, even with those addicted to such practices. Of course it should go without saying, that an institute man should be one whose business transactions at home will bear the keenest scrutiny. For be assured of this, so long as you are one among many, in your own community, doing neither more or less than the rank and file, men will expect no more of you than the average, but advance a step ahead of the procession, as a man does who attempts to instruct others, and you are singled out and stand in the lime light of public criticism.

SCIENTIFIC TEACHING

There is science and science, really in essence, applied knowledge. The true scientist, teacher or experimenter will never make the best institute worker. Such men if they be apt to teach, as some of them are, are necessarily in demand by the growing class, who read the bulletins, and are abreast of the times. They—the scientists—are able to speak with authority. In many sections I would I had one or more always with me, but they are specialists and in most cases do not speak the language, or think the thought of the farmer. Let me say right here, that if we are to be of the greatest benefit to the hearers, we must be able to do that thing. If I have had any success in institute work, it is because I have been able to place myself in the position of the poor man in the back seat, from the standpoint of a hard earned dollar. The young graduate, so full of science that it hurts him, and also full of zeal which we admire, though often it is not according to knowledge, does not fill the bill with the hard-handed and headed farmer, for in spite of Paul's admonition to Timothy "Let no man despise thy youth," unless the young man shows plainly that he has always been taught in the school of economic experience; his youth will be despised. Yet from this class are coming, and must come, the best institute workers of the future, therefore with such, brethren, be exceedingly patient and long suffering, for they should have, and often do have in them the very root of the matter.

The farmers' institute lecturer should always be familiar with the latest research knowledge on the subjects he treats. It is better not to teach at all than to teach that twice two makes six. As Josh Billings says, "Better not to know so much than to know so many things that are not true." Gov. Hoard once remarked to the speaker, "You want to have a firm grip on what you know." I would, however, say as little about science as possible. Should one go to the platform with a lot of bulletins, the inference, on the part of the audience, would be that such a man is speaking from little experience of his own, and I fear it is often right. Have the facts clear in mind and stand by them. I know of nothing more riduculous than to hear a layman get off a lot of scientific terms intended to show his learning; but they leave the impression, in the mind of the hearers, that "such knowledge is too wonderful for them, it is high, they cannot

attain unto it," and they go home and feed corn meal and buy low grade fertilizers as aforetime.

A message, a clear distinct statement of facts in simple language, backed up by *the reasons why,* is what tells. The man must have a message. There is a decidely difference between a message and a talk. Of the latter there are many. Of the former few. Some men have both. By a message, I mean, a clear definite knowledge of some one or more subjects. One that enters into the very warp and woof of his being, one which he feels will be a benefit to others, and into which he puts himself. It may not always be presented from a rhetorical standpoint, and though this is a serious defect, it is not fatal, but that man will get his audience and give them something too. A talk may be ever so well rendered, but if the soul of the man is not in it, and he is not speaking out of the depths of his experience, what he says will go but little further than the four walls of the house in which he is talking. You have a man in this State, with whom I have done much work. His use of the English language is awful, although he has improved much in the last four years. He speaks so rapidly and labors so hard when doing it, that it is often painful for his audience. But that man has a message, and in spite of his handicaps, people are always glad to hear him, not once, but many times. He always gives them something to carry away and they know he speaks of what he does know, and testifies what he has seen. I have seen him hold an audience of over five hundred cultivated people, on such a commonplace topic, as a horse's foot or tooth. That man is a power, and I always feel that I have a tower of strength when he is on my force.

Another experience: One young man, a master of English and a good dairyman, as well, spoke on butter making. He described the cream, as a satin ribbon and the butter granules as beautiful golden pellets. From a literary standpoint it was fine, but the farmer's wife, whose cream would not churn, nor the butter gather, failed to recognize in his glowing description, her unripe cream, or too soft, or too hard butter.

He was followed by a man with a message, ignorant so far as the schools go. His bodily presence was weak. Some of his matter was ridiculous, but people listened with bated breath when he described the points of a dairy cow. He knew that he had a message. These men were from the same neighborhood. The first referred to—a very dear friend of mine—rather looked down on his neighbor. At the close of the session he came to me in wonder, and said, "Why he got them and I did not! Why was it?"

BREVITY

Here is where we all fall down. We become so infused with our subject, which grows upon us, that we find our hour all too short. Except a popular lecture, for the average institute address I am sure forty-five minutes should be the *limit*, and I have laid down this rule for myself and corps for the coming season. However excellent an address may be, the ordinary mind, untrained to think logically, can only grasp a few facts, and spread out too long, they become tired, and fail to get what they might, had it been condensed. It is surprising how one can cut down and still retain the meat.

LITERARY STYLE

By what I have said under the head of message, it might be supposed that I do not value a well presented theme. No man appreciates such more highly, and the lack of it detracts from the best message. Faulty English is always to be deplored. Remember a man on the Institute platform represents the State, and is supposed to be, and should be, above the average. Among his hearers there are sure to be many cultivated people. "Aint no," "have went," and the like are inexcusable in these days, yet I have heard these and worse. Most men use too many words to express themselves, and their sentences are involved and would not sound well were they written out. Too often there is no logical arrangement of the thought, and I have known those who had no terminal facilities. They simply stopped, never finished. All these things mar. While I would never condemn one, who answered the requirements in other particulars, because of his English, I should labour with such a one to show him the error of his ways. Much slovenly work is due to lack of preparation. I have heard men say boastingly, "I never prepare anything ahead." The fact is self-evident before they finish. I contend no man should think of going before an audience until he has his subject well thought out. While I should seldom go before an audience with a manuscript, all beginners should write out their address, in order that they may get their matter in a condensed, concise and practical form. I would never commit the whole to memory—this savors too much of the parrot—but I would become saturated with the subject matter, and a few headings, and sub-headings, will easily bring out the thought in logical sequence.

HELP FROM READING

Much can be done to acquire a good literary style by reading. I fear too many institute men confine their reading to agricultural themes. These are valuable, but as an old friend once mentioned, "I want to meet a man who can talk of something else besides bulls and phosphoric acid," and I say amen. "What shall a man read?" Some of the best English writers,—Shakespeare, Milton, Carlyle, Scott, Dickens, Longfellow and Shelley, not despising some of the best modern novels, as well as history, both ancient and modern, and at least one of the leading periodicals, such as the Literary Digest, World's Work, or Outlook, and then above all the Bible. Not only because "out of it are the issues of life," but because from a literary and historical standpoint, no book can compare with it. So great a writer as Ruskin attributed his fine literary style to the fact that in his boyhood he was obliged to commit to memory many of the Psalms and poetical books and all of Paul's masterly logic in Second Corinthians. In those, who like the writer, reading is ever a delight, I strike a responsive chord, but I know others are saying, "What is the use of all that?" It enlarges a man's vision, broadens his mind, enables him to look on all sides of a subject, increases his vocabulary, and therefore, enables him to present his subject with a force and wealth of illustration otherwise impossible.

ILLUSTRATIONS

This naturally brings up the matter of stories. I claim to be a good story teller, and if Bob Seeds has any new ones, I want them, but not to tell on the Institute platform, except in rare instances.

In most of the places where I have done work the story teller is not wanted. For the time being he has the house, and his stories will be rehearsed at the corner grocery and bar-room and other gatherings, where every solid thing is forgotten. As a matter of fact people get so full of the stories that they have no room for anything else. Deliver me from working with the professional story teller. A story with a lewd or immoral interpretation never shoud be tolerated. I once saw one of the ablest agricultural lecturers this country has, disgust the better part of a large audience at a State meeting, by one statement with a lewd interpretation. The apparent fact that it was not a slip of the tongue, was what made it unpardonable. I think he has never been invited to that state since.

As I see it to-day, a story in an institute talk is only permissible either because it really and forcibly illustrates a point, or is needed to wake up a dull audience. A fact made clear or emphatic by an illustration is always desirable. As a rule the most forcible speakers use illustrations.

What about charts? Always desirable as long as they are not complex, for they are readily seen and comprehended. The mind can take in more from the eye-gate and ear-gate, than by the latter alone. Many things are hard to describe by word of mouth. A picture will show more in a minute, often, than will ten minutes talk. Few formulas can be carried in the mind. From a chart they can be copied. This coming winter, I shall to a greater extent than ever before hand out printed sheets containing tables, directions and fomulas, given in the lectures. Of many charts I have seen, the less said the better. They were fearfully and wonderfully made, and the figures on them might have been taken for the beasts in the Apochrypha. Better none than such.

FOR SUBJECTS.

It is a mistake for a man to try to cover the whole field of agriculture in his address. Better a few subjects in which a man has a message than many talks. If a man becomes known as an authority in some things, his advice will be sought after. People know T. B. Terry because of his potatoes and ——— Todd for his hogs, "Joe." Wing for his alfalfa and "Bob" Seeds for his cow-horn turnips.

A bright young man, with whom I worked in Ohio, was talking on horses and sheep, and doing it well. It was his first winter, and he seemed to think he lacked because he had not a feeding topic. I advised him to stick to his specialties and when he had made a reputation with them, then add the talk on feeding. Several times I have been asked for a man to speak on horses and sheep, and I have been glad to recommend my young friend. Would I ever have thought of him again if he had no specialty?

Avoid many general topics. Some men list half a dozen with titles that attract. I have generally found that no matter what the title the same talk in substance followed. A good wrought out general lecture is a help to any man, and happy is he who has one or two such, but not every man is adapted to that kind of work, and one not so adapted will in no way lessen his value if he sticks to his practical themes.

All of the above contribute to the best institute worker. Did I ever see one who fully measured up to that standard in the wide range of my acquaintance? I have met three or four, whom I consider approached very close to my ideal. Let us remember that the higher we aim, the higher we shall rise.

Over and above all, a man must be of broad, kindly sympathy, whose chief end is not to earn a little extra cash or achieve reputation—both laudable in their place—but to be really helpful to his fellow-men. The power of such a man will live long after he has gone. I can but express my thought by quoting the poem of Sam Walter Foss:

THE HOUSE BY THE SIDE OF THE ROAD

By Sam Walter Foss.

"There are hermit souls that live withdrawn
  In the peace of their self-content:
Their souls like stars, that dwell apart
  In a fellowless firmament:
There are pioneer souls that blaze their paths
  Where highways never ran—
But let me live by the side of the road
  And be a friend to man.

"Let me live in a house by the side of the road,
  Where the race of men go by—
The men who are good, and the men who are bad,
  As good and as bad as I.
I would not sit in the scorner's seat,
  Or hurl the cynic's ban—
Let me live in a house by the side of the road,
  And be a friend to man.

"I see from my house by the side of the road,
  By the side of the highway of life,
The men who press on with the ardor of hope,
  The men who are faint with the strife,
But I turn not away from their smiles nor their tears—
  Both are parts of an infinite plan:
Let me live in a house by the side of the road,
  And be a friend to man.

"I know there are brook-gladdened meadows ahead,
  And mountains of wearisome height:
That the road passes on through the long afternoon
  And stretches away to the night:
But still I rejoice when the travellers rejoice,
  And weep with the strangers that moan,
Nor live in my house by the side of the road,
  Like the man who lives alone.

"Let me live in my house by the side of the road,
  Where the race of men go by—
They are good, they are bad, they are weak, they are strong,
  Wise and foolish—so am I.
Then why should I sit in the scorner's seat,
  Or hurl the cynic's ban—
Let me live in my house by the side of the road,
  And be a friend to man

WHAT CONSTITUTES A GOOD COUNTY CHAIRMAN OF INSTITUTES

By HON. HOWARD G. McGOWAN, *Geiger's Mills, Pa.*

Mr. Chairman, Ladies and Gentlemen: Judging from the subject announced by our worthy Chairman, Dr. Conard, you might suppose that I possess some secret and that I would have the audacity to come across the State, from east to west, to relate it here. Such is not the case. Just why I have been chosen to speak upon this subject by Director Martin, I am unable to understand, because I have had failure as well as success. The first institute that I held, when we had with us the Hon. John A. Woodward, my friend Mr. Lighty,—I see he is present here—Enos H. Hess, of Lancaster, all grand good men, with elegant subjects, but the Institute was a failure on account of the poor arrangements by the County Chairman of the Institute—and that was myself. That is one of the failures.

To be successful, we must incorporate or inaugurate the individual interests of the people where the particular institute is to be held. Now what I mean by this is, take it in a political sense,—I am not making a political speech. I cannot if I want to. But if we are candidates for office we cannot elect ourselves. We must incorporate an interest or have the people with us. So it is likewise with the successful Farmers' Institute. We must incorporate an interest in the place by the people where the institute is held. Let me illustrate: In passing over our county but recently there was a candidate for office who had tacked his cards upon trees, upon poles, and upon buildings, and I said to a gentleman: "Mr. Smith is a candidate for such office." He said: "I don't know. I did not see him." Next day I passed over another part of our county and I said to another gentlemen: "Mr. Smith is a condidate for such an office." He said: "I can't tell you." "Why," I said "his picture, his card, is tacked upon poles, upon large trees and buildings and all that." He said: "Oh, yes; he passed through here but didn't say anything to me nor to any one in particular."

Now we will take that along with our Farmer's Institute work. Suppose a County Chairman is making arrangements for his institute. He takes his bills and he tacks them up; perhaps sends them around to one or two people in that neighborhood or community saying that we will hold a Farmers' Institute in such a place and will guarantee you that that institute will be an absolute failure, just as well as I will wager a pint of peanuts that that candidate will come out at the little end of the horn for his office.

Now what constitutes a good county chairman of institutes, in my opinion, is the man who will *do things*. That is, a man who will do things when he cannot get anybody else to do them. The good county chairman must be or should be the power behind the throne

or the silent man rather. I believe that you will perfectly agree with me in this respect. You know that if you know anything. But just how to inaugurate the interest of the people is what I think I have partially solved and that is my purpose in coming here and if I am helpful to some new county chairman in some little way, I will feel that my visit to Butler was not an entire failure.

I will give you my method of conducting a Farmers' Institute. I don't claim that it is ideal, but it works out for me and I imagine that the Director of Institutes, Mr. Martin, had some idea that I had a little success, or he would not have pushed me into this position and got me into this predicament that I am in now. Very shortly, on the second Tuesday in June, we, as County Chairmen, will be called to the offices of the County Commissioners in the various counties throughout the State, there, first to arrange for our institutes; that is, to arrange or select the places where the institutes are to be held. That is all right. You know all that. Now at that meeting we do this: We invariably select a local committeeman at that meeting for each place. Never miss doing that. If you simply just select the places nobody is recognized, your meeting sort of falls flat and the local papers have not much to say. But if you select a local committeeman and chairman, the local papers take it up, publish the proceedings and somebody is recognized and interested. After that there is not very much work to do until we commence to arrange for the institutes. About six weeks before the time for holding the institutes I commence to get very busy. I do this: I correspond then with this chairman who was made at the time and places for institutes were named. I make an arrangement to meet him at a certain place, day and the hour named. I have never missed an appointment of that kind. I say to him, now call in your farmers, call in all those who are interested in the success of the Farmers' Institute. And he does so, and I have had as high as twenty, twenty-five and thirty of the live farmers at that preliminary meeting. He also sends out postal cards informing them of the meeting and why they shall come and make arrangements for the Farmers' Institute.

Now a step backward! By this time the Department has sent me the posters and the printed matter such as they send out. I have already, previous to this, taken these posters to our local printer and had him very nicely execute and insert suitable type where is is necessary, stating the day and place of holding the institute, together with the names of the speakers, all nicely printed in that bill. If I hold four institutes and the Department sends me 100 bills I have 25 for each place. I tie these up in a little roll and I have a bunch of the Farmers' Institute Bulletins with me, and I go to meet this pre-arranged gathering. I preside there myself, call the meeting to order and tell them the object of the meeting. I take the Farmers' Institute Bulletins and I say: "Now, here, gentlemen; we have Prof. Lighty, from East Berlin, Adams county. He has five subjects, he has eight subjects, or whatever, and we can select five of them. Now, gentlemen, whatever subjects you want in this particular community you just tell me. This will interest every man. I came here to assist you. They will all get busy and I distribute half-a-dozen Bulletins to these fellows and we all have something to do. We read over these subjects nicely and carefully and pretty soon we are so much interested and they select the subjects and I mark them down. We

take the next speaker and we go over his subjects and we all have a say in the selection of the subjects they want at this particular place. I say we will now have the chicken man, Mr. Wittman—probably we are fond of raising poultry. We also have the scientific fellow, Prof. Mair. So we select the subjects and all have a chance and a say in the arrangement of the program. Now we do something more right at that meeting. I say to those present: Now, gentlemen, we intend to send out about 100 postal cards. We will commence right here to select names and we will make a circle all around the section where the institute is held for a radius of four, five or six miles. I say, now if there is any person here handy with the pencil they will set down and take these names down. There is always some one who will do that. So we commence to go around this whole section and they will mention names as fast as the secretary can write them down. So every man has a name to suggest. Send this man a card, the other fellow a card, and those present have all been doing something and been thoroughly interested. Now this is the card (showing). These cards are sent out independent of the cards sent me from the Department. They seem more original. There is always inspiration in numbers and I take it that the successful institute must certainly, in the first place, be well attended and this is what I am at, to get a well attended institute. (Reads):

"Dear Sir:

You and your family are cordially invited to attend the Farmers' Institute, to be held at Reading, Pa., on Friday and Saturday, February 19th and 20th, 1910. Speakers will be present from various parts of the State to talk along agricultural and horticultural lines. Farmers this is your meeting. Come and hear the various subjects discussed, relating to dairymen, potato culture, fruit raising, poultry, etc." (Signed by the local Chairman in that community.)

All nicely printed. That makes the local chairman feel good and personally interested.

At that meeting we do something more. We create what we call an executive committee. I take this chairman, who was made chairman of the local committee at our meeting where the institutes were named, as chairman. We place five men on that committee. Then we have a larger local committee. That committee may be increased probably to 12, 15 or even more. We name the query committee at that time. In fact, we pretty nearly make the entire program. Now when the meeting is pretty nearly over, and by this we have had quite a nice little time together. I now unwrap these bills I have there. We have a nice showy type—a finished bill—no blue pencil mark or anything of that kind that looks cheap. That is not attractive. You all can do that. The Department is doing all they can in this way, but the printer only charges a small sum for making additional type and that goes along with your expenses. I say: Gentlemen you will distribute these bills as much as you possibly can, covering all the ground. Now, I told you we have 25 bills and almost every man goes away with a bill, some with two bills, some with three. And they will discuss these and they will say: I will take this bill to this place and this bill to that place. We have all

had a hand in the arrangement of the institute and I tell you, my friends, that is the secret I have had in the whole thing, and that is the particular message I want to bring to you today. After you have done that you have broken the backbone of what I term the success of the Farmers' Institute. It works its way out splendidly. You have 25 or 30 men to talk farmers' institute right from the start. They will talk with their friends and put up the bills. But, as I said before, if I simply went into that community and called the chairman or local committee together and he and I had a private conversation together like happens sometimes, it would have been between us and that would have been the end of it. I haven't had a failure at all since I have adopted the plan just described.

Now should a good chairman preside at the institute when held? This is important. I have presided but I have learned this: Not to do things when I can get the other fellow to do them. Sacrifice yourself every time. Right here I want to read a little letter that was gratifying to me, that will bear me out on what I say. I want to prove things as I go along so you don't think I am here just talking. I received this letter after an institute was held in my county, Berks:

"Dear Mr. McGowan:

> I am very much interested in the work of educating the farmers in better methods of tilling the soil and hope to be situated soon that I may be able to demonstrate from practical experience the truth and wisdom of many years recommended by these men at our farmers institutes. Accept my thanks for *your* courteous treatment during our institute, much more than I or we deserved. I told a company of my friends last evening that I entertained the very *highest* regard for you, because you seemed to be so deeply interested in this work, and that you were so generous that you took pleasure in giving *others* credit for more than they were entitled to, reserving nothing for yourself."

Now, gentlemen, I contend that this is the position that a good chairman should occupy. He should be the "power behind the throne," and only do things when he cannot get anybody else to do them. It is not safe, however, to allow an institute to be in charge of *some* chairman. That probably would not be wise. It is safe to select the best man in the community for the local chairman; but almost any man can preside as chairman provided the county chairman holds his hand upon the throttle and has tact. That is what we must have. We must know every move that the institute is making, feel every jar that occurs in the meeting, although you can be silent and guide all this; and the chairman in that community will feel that he is honored and that he is respected and that the county chairman is not doing all the work and that he wants to be the whole push.

We are generally active with the query box. I make that a feature at our institutes. The chairman of the query committee is not an idler. I emphasize the question box and insist on asking questions. Get people at it. They will be slow at first, but get them at it. The chairman collects these questions. Now then I have another man,

who is a good reader, at that institute. He comes front and he reads these questions. So that gives somebody else something to do.

So all in all, gentlemen, you see that a good county chairman must be the power or should be the power or like the silent partner of a business concern who is sometimes, or generally is, the strongest controlling factor in the business. A good county chairman should be a sober man; he should be honest, truthful, diligent, charitable, always having regard for the other fellow, forgetting yourself, imbued with the responsibility of teaching and leading men to learn and to love agriculture which, my friends, is at the very foundation of all the material wealth and prosperity of our country. As we came over the railroad to Pittsburg, I and Brother Lighty sat upon the same seat, and as we passed by these great iron plants, we conversed together and we almost came to the conclusion that they seemed to be the main spring of the prosperity of the country when we saw the twining smoke going heavenward. We went on to Pittsburg and by the adjoining places, gazed at the gigantic buildings, many stories high, and listening to the hum of these mills and factories we almost came to the conclusion that *that* was the mainspring of the prosperity of our country. Again thoughts took me to Washington, the seat of our National Government, and beheld the vaults of the United States Treasury, and I began to think is this the secret of our prosperity; but I made up my mind that it was none of these things. While I regard these things as all important and necessary; yet, my friends, the real seat of the prosperity of this country is in the cultivation of the broad acres of our great State and the United States, the products of which produces the greatest wealth which feeds the world.

A good county chairman should love his work. A man who does not love farming should quit it. The man who loves his business will be a success. The lady or gentleman who loves to teach school will be the best teacher in the community. Now in the spring of the year, when the birds sing and the grass grows, we imagine that every live teacher is anxious to quit their schools. Just this spring I met a teacher and I said: "Bessie, you have only three days yet and I suppose you are very glad." "No," she said, " I love to teach;" and that is one of the best teachers we have in our township. So a good county chairman must love his work and love to do things, and must have an interest in the other fellow. If he does not love the work and like it, he had better quit, resign and let someone else take his place.

My friends, my brother county chairmen let us combine the best qualities, the best efforts that are in us in performing this great work that is given to us in this high calling of managing farmers' institutes in the various counties of this State. Let us combine these qualities and all the best efforts in us as much as consistent with our active work upon the farm, and then I am sure and believe that we will be judged as men among men in the great Commonwealth of Pennsylvania. A good county chairman should be a rich man, as I think sometimes; not very rich; just about rich enough to board himself and work for nothing.

MOTHERS AS CHUMS

By MISS ARABELLA CARTER, *Philadelphia*

Recently I heard a girl say in speaking of her letters to her mother and her replies: "I usually begin mine 'Dear M.', and she hers 'Dear A.' We do not bother with mother and daughter; we're 'chums,' Mamma and I." This expression set me thinking, and as I talked to that girl who had her mother for her "chum," I learned that which caused still deeper thinking and I wondered how much teachers and advisors of the young—and even mothers themselves, actually understand of girls anyway. Do they not too often leave their own girlhood days far behind them, and of forgetting their own early aspirations, joys and troubles, fail to bridge the gulf of years between them.

Some dignified, elderly hearers may have a wholesome horror of anything which would seem a retrogression from the old-time filial reverence, the absence of which is so much deplored to-day. And I grant "Dear M." is a long way off from "most revered mother" of "ye olden time." But let the reverence be in the spirit rather than in form if the 20th century girl cannot accommodate both, but I believe she *CAN*. I ween the true love was not lacking in that girl for her "mother-chum." "Why," she said, "when I was home and went to parties and all sorts of social affairs, a large part of the fun was telling Mamma about it that night as I undressed, if she was waiting up, as she often was, or the next morning as we worked together, for she was just as much interested in all the little details as I was. She never sneered at our frivolity, but enjoyed everything with us. When we had company Papa and Mamma were a part of the crowd as much as anyone, and the young folks used to say 'there's no restraint up at B's.' There was no sitting apart in another room for them, nor was it thought of or desired by anyone. If by any chance they were away a ready inquiry was made and a genuine regret expressed." "And when I left home," she continued, "to make my own way in the world and went home at the week-end, there was so much to tell of what happened during the week; and I'm sure they looked forward to my weekly budget just as much as I did the saving up things to tell, and they were just as sorry as I when anything kept me away. Why, it was a standing joke about Mamma and my talking until 12 or 1 o'clock on Saturday nights, that she kept me up as late as my weekly caller did!" "Yet," and here I noticed her thoughts traveled back to the beginning of our conversation, as a thoughtful, tender look came over her face, "I do believe I cherish most those occasional letters who Mamma calls me 'dear daughter,' for I realize then that is the title only one person in the world can use to me:" and the tears filled her eyes at the thought of that father so recently called from that loved home.

Fig. 3. Women's Session, Illustrating Domestic Science.

"And if I feel so, perhaps Mamma does too for the same reason, I'll see." Here I saw the ready willingness to give up the "chum" for the "mother," if so desired.

But I know all girls have not this close companionship, and I pity them. Some may have been deprived early in life of their mothers, never knowing in their own experiences the possibilities of a mother as friend and confidant. Others there are who do not live so close to the mother in sympathy and love; perhaps it's the mother's fault, perhaps the daughter's.

I like the word "chum" in this connection, it means much. Perhaps it embraces more than any other could possible do in portraying certain phases of relationship—sister, friend, confidant, all in one—a nearness that, dear as the word mother is, could not be covered by that alone.

Some days ago while coming into Philadelphia on the train from my home in the country, I chanced to overhear the conversation of two mothers seated behind me, and each gave due credit to the lovableness of the other's child—a thing not too frequently done. And as one mother spoke of her daughter in her social relations with her young friends, and told of the little merry-makings and parties, she dropped this remark: "I try to keep very close to Ruth and am with her in her pleasures; I do not feel it detracts at all for her friends look upon me as a sort of sister of Ruth rather than in the relation of mother; we're very chummy, Ruth and I." O! how I rejoiced for Ruth. Having always been surrounded by this love of her "mother-chum," she cannot realize what many of her friends lack—cannot see the emptiness of other lives where the mother does not fill the place as in her own.

Here we have the attitude of the mother who is "chum" to her daughter from the mother's point of view as we had it previously from the daughter's. And the little glimpse into the home-life vouchsafed opens to us the beauty of comradeship, is it not beautiful? Can we not picture the heart talks of that mother with her girl?

Just here let me speak of a little story I read some years ago, a part of which has remained with me ever since. I do not remember the author or the name of the story, but the point is this. A girl surrounded by the loving atmosphere of a good home, where she was watched carefully by the right sort of mother, went to visit an aunt and there met a boy just reaching young manhood, who, as a baby had been left on the poorhouse steps, and growing older had found refuge with this kind lady. He seemed to have within him beautiful thoughts which he wove into stories, and had one he was reading to this young girl for her to pass her opinion. He had reached a point where he spoke of the mother in the story when she interrupted him with: "why, you have not made that mother half good enough, my mother is far better than that." John replied, "That is quite likely, I have never known a mother, this is only my ideal of what a mother should be, while your mother is God's ideal of a mother made *real*". Can we not learn a lesson from this? Are we not too apt to feel when discouraged that our ideals can never be reached, that they are too high, forgetful that our ideals are never too high to become God's reality.

Girls, do you say, "Oh, well, my mother does not take the same interest in me that those girls' mothers did." Are you sure? Have you proven the truth of that statement? She may show her interest and love differently, but if she be a true mother it is there. Give her a chance to show whether she cares for your confidence. It may seem strange at first to seem to thrust it upon her apparently unasked, but under the calm exterior there may be a hungry heart-aching for this which you alone can give. Do you not go to her with your troubles sure of sympathy and help? Why not with your joys as well? I'll guarantee that in the majority of cases her heart will respond readily. It's worth the trial anyway, won't you try it?

Yet there are mothers it's true and "pity 'tis, 'tis true," who are too much engaged in having a spotless home or in fashioning fine garments for their girls, thus expressing their love for them, forgetful of the fact that the young hearts under these gowns are starving for sympathy and love, unmindful of the fact, too, that they are driving these same young souls to find companionship in a "chum" less safe, less helpful. Mothers! May I ask you to pause ere it is too late, and meeting her half-way, endeavor to be a "chum" to your young daughter who, tho' "bone of your bone and flesh of your flesh" must have someone to "tell things to" and talk things over with. Let that someone be you. Do you feel you have done your duty when you have provided for her temporal wants? That as a growing girl she is not to be considered in any way a companion? Do you think she is ever and only a child until the larger experiences of life come to her and then you suddenly awaken to the fact that she is a woman—a being like yourself. And then you are amazed at your blindness that you did not see the quiet unfoldings of that nature ever before you, and you realize that the period 'twixt childhood and womanhood has been lived without you. You have failed to help her interpret the messages along the way and you have lost forever the close companionship both for her and for you during that precious time which cometh never again. If you have another daughter, will you not as a child cultivate her sense of importance to you? Try to make her a companion and she will readily respond and be proud to be considered of value to you. I recall an incident of my little niece not yet ten years old, when her mother was sick and I was for the time taking her place, I had considered her a little fly-away without much thought of anything but play, but as I consulted her about minor points- the dishes to use, the way we should do things, etc., in order to make her feel some responsibility, I was amazed at the womanliness manifested; she was rising to meet my needs as she saw them in a way of which I had not deemed her capable, and I called her then and since by the name which has, perhaps, more than any other, endeared Louisa M. Alcott to us, that of "little woman," for I saw even in that little child the spirit of helpfulness which must exist in every true woman.

When your daughter goes to a home of her own, then your interests are more similar I grant, and your experience can teach her much in the new work of managing a household—and a husband. But much as a mother may be of value then, I question whether she is actually needed so much as she is as "chum" to her growing daughter.

And it's not only girls who need "mothers as chums." I recall with pleasure an afternoon spent with a mother who spoke of being "chums" with her boy just growing into manhood. She was interested in his work and in his pleasures as well, and was looking forward to a little visit of a day or two which he managed to sandwich between trips as a girl looks forward to the visits of her sweetheart. So young did she keep herself with this companionship, that despite poor health, she was often taken for his sister when they were out together.

I recall with far less pleasure another mother who came to me to ask the most ordinary questions concerning her son's whereabouts on certain dates, because, knowing my friendliness with him she thought I'd know, and she did not have her son's confidence as to where he was going or with whom. I was able fortunately that time to tell her and satisfy her mother-heart, for he had been where she wanted he should be—in safe company. That mother kept a spotless house for her son to live in, she would get up splendid meals for company to entertain him and his friends; she would stand for hours ironing her best table-cloth after entertaining until, weak, frail woman that she was, every nerve was atingle and muscles strained with the exertion. Yet she did not take time to become acquainted with her son. What wonder that he went wrong and his mother's heart was wrung with anguish when all too late? But was the fault all the son's? And sad it is that these cases are all too many.

I might say a word regarding the value of the mother as a "chum" to her husband, but doubtless I would be stopped, for I understand one can deal only on this platform with the things one really knows, and personally I've no experience along that line, but I've quantities of theory.

The relation of parent and child is a theme frequenty dilated upon by writers in these days. Ella Wheeler Wilcox recently, in speaking of the education of parents cites the case of Alexandra, mother of Herod's wife, who fearing a fate similar to her daughter's, rose and bitterly reproached her for a crime she knew she had not committed; so Herod's wife went to her death knowing her own mother was a traitor to her. She mentions this to show the evolution of motherhood since that day, and says: "Surely nowhere * * * could such a mother be found today. I have known mothers who were jealous of their daughters, I have seen many who were unkind in small ways and lacked sympathy. Thousands of mothers fail to win the confidence of their daughters." But she does not tell us why. Is it because the mother has not made a study of her daughter's nature and cannot understand its changes and proclivities? Is it because she has not been a "chum?"

Another writer charges a lack of love and duty on the part of the child, saying, "Many mothers have given youth, beauty, health and strength, and when lines of care mark their faces with wrinkles, and her hair is streaked with gray, how many are rewarded by the devotion and care of those for whom they have done so much? Not so many as there should be." This is a sad picture and true, yet I must say it does not appeal to me quite so much as some other phases. I trust I am not lacking in duty or devotion to parents, or in the family love which must bind families together in unity; and

I may be taking the unpopular side when I say I fail to understand why so much talk of the duty of the child in the abstract toward a relation it had no voice or will in forming. Having thrust upon it the requirement of devotion and care in instances where there is little in nature to call it forth. So many writers speak of parents sacrificing everything for their children as tho' its very birth was a sacrifice for the child. Parenthood to my mind is *not* a sacrifice, it is a relation willingly assumed and entails upon it the duties of the parents because they *chose* it for more than it does upon the child who was ignorant of its coming.

This does not mean that the later care and tenderness given to the child should not receive in turn from the child all the care and devotion called forth by the parents in their relation as parents, but let it be a loving willingness and not a forced duty. Let the attitude of the parent be such as to absolutely force by loving propagation all the enlargement of the child's capacity for love—let it fill, so far as possible, all the needs of the child nature through the actual giving of the parent itself and there will be in the majority of cases, no lack of the spontaneous giving of the child's full allegiance.

I recall how, years ago, the burden was lifted from my heart when, for the first time, I heard the last clause of the Biblical command, "Children obey your parents." From pulpit and from platform we hear this thundered forth, striking terror ofttimes to the child who feels the whole burden is his, but when softened by the latter clause of, "Fathers, provoke not your children to anger," and the duty is shown for the parents as well, the child feels relieved. So, all through, it seems to me, the duty is two-fold—the child shall give its obedience, but the commands of the parents are to be such as the child *can* obey!

Mother's Day, which has thrice been lovingly observed, has tendered many hearts and wakened many memories in the minds of the man of business, the scientist, the scholar with whose childish days the mother hovered as the beneficent factor. While fine as a memorial, it fails to take the place of the loving thought here and now—the caress, the deference, the devotion to one whose life was lived for her child.

The white carnation worn by loving, stalwart sons and matronly daughters savors of the esthetic and the beautiful, yet more beautiful still is the *action* toward those who have stood the storm and stress of a busy, helpful life. The beautiful tribute of flowers laid on a coffin-lid may testify of love, but better testimony is that of flowers given in life, the kiss of appreciation and love given while the eyes can brighten at the touch and the cheeks tinge with pleasure. Let those of us who have the mother here, who, being a true mother in all the term implies, deserves this honor, see to it that no lack on our part shall embitter the parting hour or the sad, lonely ones to follow.

Edgar Allen Poe, whose pen has enabled us to know and love for the aspirations he cherished but never realized:—and though his life held mistakes it held many beautiful things as well—drew us by an unmistakable cord when he called mother the "Name Incomparable," and said:

"In the heavens above
The angels whispering to one another,
Can find among their burning terms of love,
None so devotional as that of mother."

Just a parting word to the girls. A friend of mine laughingly questioned my ability to cope with this topic, saying: "You're not a mother, what do you know about it?" True, I'm not a mother, but I am, or have been a daughter. And I had a mother similar to the one portrayed by the first girl I mentioned. She left me a short time ago, the curtain of silence has fallen between her dwelling-place and mine, and the sweetest memories I have now are those wherein she was my confidant, my friend, my "chum" as well as mother. I loved her none the less because she took the place of sister also. With her has gone so much of my own life. So many things occur continually I want to tell her as of old. And from my own experience let me say with Longfellow:

"Lead thy mother tenderly
Down life's steep decline;
Once her arm was thy support,
Now she leans on thine.
Thank God for thy mothers' love;
Guard the priceless boon;
For the bitter parting hour
Cometh all too soon."

And I know of no way to soften that parting hour like filling the present so full of sweet memories that the bitterness of duties unfulfilled can find no place there. Make sure you are to your mother *now* all she wants you to be, allowing her to be to you all her loving heart prompts as mother and as "chum." Won't you, please?

DOMESTIC SCIENCE AND THE HIGH COST OF LIVING

By MISS SARA C. LOVEJOY, *State College, Pa.*

The subject of the high cost of living has been so thoroughly discussed in every newspaper and magazine in the country that there is no one here who can not give at least five assigned reasons for the present high prices. Daily papers, religious weeklies, monthly literary magazines, and all periodicals dealing with the farm and the home are vying with each other in explaining most fully the the causes and cures for existing conditions.

What are some of these? As given by different authorities, they are: Too much gold; too little gold; increased knowledge and pursuit of agriculture; decrease in agriculture, owing to other occupations, high tariff, low tariff, trusts—particularly the meat trust;

lack of national control of natural resources; government interference with natural resources; increase in population; more luxurious way of living; lack of wisdom in the expenditure of money by the women. These and many more reasons are given, with a correspondingly large number of solutions for the difficulty.

I am not the person nor is this the place to weigh these and to try to find out more explanation. Most of us to-day are too vitally interested in our own homes and in the immediate effect of present conditions upon our own pocket books and households to care to discuss broad national issues. Moreover, we need not confine ourselves to the cost of living in money only, for at this day with its complex demands, living costs much more than mere money. It costs too much in other expenditures—health, strength, comfort and even happiness. Shakespeare says in one of his plays: "Men die because they know not how to live." To meet our present conditions we might paraphrase this: "Women are dying before their time because they know not how to save time," or if they are not dying, they are ruining their dispositions, digestion, and often their domestic tranquility because they do not know how to keep house properly—how to conserve their natural resources of health and strength, as well as the acquired resources of money.

Some of you are doubtless saying: "Why talk about the causes of the high cost of living? What we want to know is the cure and how do you propose a remedy through the vague term, 'Domestic Science.'" To many people to-day this term suggests little because they suspect we are talking about a mere theory, something which is studied in colleges, which is perhaps being introduced into some public schools under the name of cooking, but which has no place in the practical affairs of the home. They tell us that "the people who talk about it have no homes of their own, and do not know what it means to wash and iron and bake; there is, therefore, no more value in Domestic Science than in a book of rules of what to do in case of drowning—when the book is in the house and we are in the water."

A few years ago men thought the same thing about agriculture. It was considered farming on paper with pen and ink as tools, instead of on the farm with plough and rake and hoe, but few to-day fail to recognize that the most successful farmers work with the head, as well as with the hands. The man who makes money out of his acres is the man who understands the structure of the soil, its possibilities and needs; and who is ready to meet modern conditions with modern methods. The man who makes money from his poultry or cattle studies the problem of feeding and housing these with the two-fold object of supplying best these needs and of doing it at the lowest cost. If he slights either of these objects, he may have some success, but he will not have the highest.

Now, Domestic Science, or as we call the broad term, "Home Economics," merely means to the home what agriculture means to the farm. It is a study of the problems and conditions of housekeeping in the twentieth century. It includes not merely the theory of what food elements the body needs and of how to supply these at the lowest cost, but also practice in marketing to secure the best food values and in actual cooking to get the best results from the

food chosen. It includes not only the theory of the effect of certain chemicals as found in the various soaps, washing powders and blueings on fabrics, but the actual practice of washing; not merely the theory of suitability, artistic effects, and cost of various textiles for clothing, but practice in sewing and dressmaking; not merely the theory of planning the work of the household systematically but practice in housekeeping.

Is this not a study of as serious import as any in the world, for what other institution bears such a direct relation to the physical, mental and spiritual welfare of the human race as does the home? Why is it, then, that we are content with managing our homes according to methods of fifty years ago? Why do many people still feel that any girl, by virtue of her sex, can manage a home successfully? It is as well to expect a boy, because his father is a physician and he runs in and out of his father's office many times a day, to understand the profession of medicine, as to expect a girl, just because she lives in a home and sits at the table three times a day, to understand without study and training, how to select and prepare the food that shall best furnish what the body needs for its complete development and maintenance, at the most reasonable cost, or to plan and carry on wisely the other work of the household.

Until we women realize that our business in life (for housekeeping is the business of seventeen millions out of the twenty-four millions of women in the United States), is as important as any other, and that it is, moreover, not drudgery but a profession, an art and a science, and until we undertake it intelligently, with the purpose of doing it, not merely *well enough,* but in the *best* possible way—that is, with the least expenditure of time, energy and money, and with the largest returns in the health, comfort and well-being of the family, we are failing to do our part of the world's work. One writer has said that the chief duty of a woman, as a citizen, is to be a good housekeeper and home maker. This does not mean merely to be able to wash, bake and sweep so that we are clean and have enough to eat, with no strength or ambition left for anything else. It is, instead, doing these things well, as a means to our end, subordinating the material to the higher side of life. It means so regulating the household tasks that the mother may have time for something beside actual house work, time for reading, recreation and growth; time to train the children in the home. The poor woman who says she has no time to train her children because it takes all her energy to feed and clothe them is losing half her heritage and is depriving her children of their due.

Now what are some of the things our housekeepers need to know, in order to lessen this cost of living in time, health, money and happiness? The largest amount of money spent within the average home for any one item is for food; and the greatest amount of time spent within the household for any one task is for food. The reason for this is that we often mistake quantity for quality, variety for well-cooked food, high prices for nutritive value. Those who are interested in dairy husbandry find it necessary to spend time and thought in calculating the proper feed for their cattle, with a view to providing the necessary food elements at the lowest cost. In arranging a dietary the housekeeper has other matters to consider besides cost and nutrition. She must choose food that is also palatable,

properly cooked, and suited to the age, occupation and condition of the people for whom she is providing.

The needs of the human body are not greatly different from those of other members of the animal kingdom. We must have materials to build up waste tissues, to supply the bones, and to furnish energy for bodily activities. Unless food fulfills all of these functions, the body pays the penalty. If we have not sufficient protein to repair the wear and tear of the body, we soon become inefficient and various ills assail us; if we omit mineral matter, bones and teeth suffer, and if starches, sugars and fats are not consumed in large enough quantities, we have not the fuel with which to supply necessary activity. Moreover, if our diet is confined too exclusively of food supplying only one of these elements, no matter how much we consume, we are underfed, and are wasting money and energy. For instance, if we have a meal composed chiefly of bread of various kinds, of several of the proverbial Pennsylvania "spreads," and cake, we are supplying merely fuel, and presumably too much sugar. If, on the other hand, we have beef steak, eggs, lima beans, a glass of milk and custard pie, our meal is to heavy in protein.

Because most of us recognize lean meats as a source of the protein supply, we feel that the more meat we eat the better fed we are; and here lies one reason for the present high prices. While meat should form a part of the well-balanced dietary, it need not be eaten in such large quantities as it is. There are plenty of substitutes which will furnish the protein and, if properly cooked, are as palatable, digestible and much cheaper. Cheese which is usually regarded rather more as a condiment or relish than as a staple article of food, is rich in protein and can be cooked in numberless ways. Eggs, milk, nuts, cereals and legumes all furnish to the dietary what meat does and yet are rarely substituted for it. The following figures may help us to understand this better:

	Per cent. of protein.	Cost per 1,000 calories.
Beans (dried), ...	22.5	3 cents.
Sirloin steak, ...	16.5	25 cents.
Cheese, ...	25.9	8 cents.
Eggs, ...	13.	39 or 13 cents, (according to season of the year.)

That is, a dish of baked beans and pork will cost for the entire family, seven cents; steak for the same family will cost about seventy cents, and will contain less protein and little more fat. Moreover, beans and eggs do not cost, on the farm what they do at the town markets. In fact, in the winter time eggs are almost as valuable in the city as currency and for this reason many a farmer thinks it cheaper to sell his eggs and buy meat than to use them at home. This is, however, one of the economies where all sides of the question must be weighed.

Another way in which as housekeepers we are deceived is in regard to goods sold in retail packages. Here again we must weigh carefully the cost in money with the cost in ease of preparation or

preference in taste. Rice is eight to ten cents a pound in bulk; puffed rice is twenty-seven cents a pound, and moreover, a pound of unprepared rice will, when cooked, be greater in bulk than the package of prepared rice. Cornmeal, which by the way is rich in fuel value, costs about two and a half cents a pound; corn flakes cost over fourteen cents a pound. In the case of both of these cereals it may be urged that the prepared variety saves work and fuel; moreover, we may prefer the taste of corn flakes to corn meal mush. All this is true, but it is the business of the housekeeper to consider it and to decide which in her case is of more value—to save money or to save labor and fuel. It must be confessed that often it is wiser to do the latter, but let us be very sure that we know which we are doing and why we are doing it.

A further reason for the high cost of food is that we waste nutritive value by improper cooking and so expensive food materials are failing to supply the needs of the body. The best cut of steak or eggs fresh from the nest may be so spoiled by being overcooked, usually by frying that they injure rather than help the body. Moreover, a cheap cut of meat cooked slowly and thoroughly, as in a fireless cooker, is far more nutritive than an expensive steak fried rapidly until it is similar to leather in consistency.

The mention of the fireless cooker suggests another means of reducing the cost of living, if not in actual dollars, at least in expenditure of labor. When housekeepers learn that within the house as well as on the farm, it pays to spend money for new appliances to lighten and facilitate work, then we shall hear less about the drudgery of house work, and then will our farmers' wives have more time for other pursuits—for physical, mental and spiritual regeneration.

Again, as in the matter of food, we must consider our special needs. Perhaps what saves labor in one home may prove an extra burden in another. However, we all need some better facilities for work—running water in the house, bath rooms, cook-stoves and sinks conveniently placed and of the right height. We should put more study into the arrangement of the workshop of the home—the kitchen—so that every needed utensil may be so placed that we do not take two steps where one will do. In many a farm house we economize and sometimes go into debt in order to buy a heavy brussels carpet for the parlor or an elaborate piece of stuffed furniture—articles which will be harder to take care of than plainer furnishings. At the same time we leave our kitchens just as they were built forty years ago, with the stove several rods from the sink or kitchen table and with the pantry shelves another two rods away, and we are content to do our washing with as few facilities as it was done fifty years ago. Many a woman will insist upon having Nottingham lace curtains at her parlor windows and yet will feel that she cannot afford to have her windows and doors properly screened from those store-houses of filth and disease, the common house flies.

We are increasing the cost of living, then, by spending too little in our houses for what will add to the comfort of the family, to the ease of the housekeeper in performing her duties, and to the health of the household, as well as by spending too much money without wisdom.

One more great source of expense in our households is clothing. Here, however, we are justified in saying that we who live in the rural districts are less extravagant than are the dwellers in towns where the stores are often a constant temptation to the bargain-loving instincts of womankind. Nevertheless, wherever we live we have plenty of opportunities to be wise or foolish. We are sometimes deceived by the cheapness of a fabric into buying shoddy goods that wear out almost before they are made up. We buy five-cent muslin instead of ten, regardless of the fact that it will shrink twice as much or that when the dressing is thoroughly washed out, it will be limp and sleazy. On the other hand, we pay an unreasonable price for a hat or suit because it is a fad, or is more elaborately trimmed than a plainer, more serviceable article. The textile industry is one that we, the consumers, must sooner or later regulate. Pure food laws are, to some extent, protecting our interests in regard to those supplies; pure textile laws must follow, to protect not our health, but our economic interests. Meantime it behooves us to consider more carefully whether we are getting the value of our money.

This leads us to the direct question of our expenditures. How much are we spending for all these necessities of life? How many housekeepers know how much the food, the clothing and the operating expenses of their households were last year? The definite statistics are much harder to estimate when we are living on a farm and so do not pay in cash for all of our commodities, than when we are living on a stated salary in a town. Nevertheless it is the duty of every farmer and of every farmers' wife to have a systematic division of expenditures and to keep a cost account. No business man, no matter with how large a capital he is working, would keep on for a year unless he had accurate bookkeeping by which to account for every cent expended, and yet we in the home go on from year to year with a vague, general impression of how much we have and that most of it is spent. Before we can do much to settle the problem of the high cost of living we must put the management of our homes upon a business-like basis.

These, then, are some of the ways by which Domestic Science is to help the housekeeper solve her problems; by teaching her both how to cook and what to cook, by showing her the value of new methods of doing old tasks through modern labor-saving devices, by training her taste with regard to clothing and home furnishings that she may get the best value for her money and by helping her to regulate wisely the expenditures of all the resources of the household. Science, art, and economics are all included in a knowledge of housekeeping.

State College is the only institution of collegiate rank in this State where training in this branch of knowledge is given, although several technical schools do work in this line, and at this institution the course has been a twofold object to prepare girls to be intelligent, wise house wives, and to fit them for professional service either as teachers or dietitians. The demand for women thus trained both in scientific theories and in actual practice is greater than the supply. To this end our students work hard at their sciences, chemistry, bacteriology, physics, and also at the practical work of cooking, dietetics, washing, ironing, cleaning, sewing, dress-

making, millinery and all kinds of hand work. Economics both in its general phase of the production of wealth and in its application to the expenditures in the home is also included. The practical nature of this work is illustrated by the fact that the students are required to plan, cook and serve actual meals, the really elaborate ones costing twenty-five cents apiece for each person served; the less elaborate, furnishing all the necessary food elements, costing but twelve cents a day for the three meals.

Many a housekeeper of experience questions the possibility of such meals, but the students at State College can do this, and have the actual figures to prove it, since they are required to keep account of every cent spent and of the total nutritive value of each meal served.

One object in having this course at this, the Peoples' College of our State, is to train teachers, and this means that you who represent various communities and school boards must be the next to act. It is your province to see to it that these branches are introduced into your rural schools so that every girl may learn to keep house not merely from her mother, but from scientifically trained teachers who have made a study and application of the progress of science as it affects twentieth century housekeeping. In the kitchen as in the field we can learn much of practical, but in the schools as they should be to-day, we can learn more of both theory and practice. If the next generation of housekeepers is to be thoroughly efficient to cope with changing conditions, the girls of this generation must be taught systematically. Then we shall recognize that the cost of living is what we make it.

WOMEN'S SHARE IN AGRICULTURE

By MISS MARTHA VAN RENSSELAER, *Cornell University, Ithica, N. Y.*

(This lecture was illustrated with stereopticon.)

In prehistoric times men sought the woods for hunting and learned its language. Women learned to till the soil for food and learned her lessons from the nest builders and workers in clay.

Man's first desire was for food. He laid his game at the door of the woman and she learned to prepare it. She used the fruits and vegetables within her reach. She was the first farmer with a crude implement in her hand. She domesticated the cow and other animals to aid in her efforts for food. She built granaries and with crude implements ground the seed for bread and porridge. She cleared the forests and learned the use of fire in preparing her fields for cultivation. She became as a beast of burden and transported her provisions to her dwelling and crude storehouses.

Agriculture in primitive days was beneath the dignity of men, but in the keeping of the herds they took the lead while to women

was left the elements of agriculture. When the first lessons were learned and farming was a more developed industry, gradually the women confined their labors to the preparation of food and the men to the tilling of the soil. It became a means of keeping the family together and leading men to have a permanent abode.

In the progress of nations it was found that agriculture would pay a larger tribute than war and men turned to agriculture as it became more complex. Now he stands in the foreground in the agricultural world with woman at his side as a helper as in no other business. Woman as the original farmer was the forerunner of the housewife and the worker on the farm. She has not only aided her husband in the work and management of the farm, but has become an independent farmer. In 1870 there were in the United States 733,332 women laborers. Twenty years later there were 663,209. There was a larger increase in the same time among women who had charge of farms. In 1870 there were 22,681, in 1900, 307,706.

(Slides were introduced illustrating women at work in various lines of farming.)

In modern times men are being educated for farming. Only until recently has it been recognized that for the problems of the woman in her farm home an equal education is needed. We are paying more attention to the raw material than to the preparation of it for human nutrition. We are paying more attention to prevention of disease in animals than in humans. We are educating the boys for their real work in life and paying too little attention to the preparation of girls for living and helping others to live. We have not yet placed an economic value on a woman's time and labor.

The teaching of Domestic Science must become an inevitable accomplishment of the teaching of Agriculture in rural districts. Farmers' Institutes have been provided for years under state enactment. The women on the farms have gone with the men to these institutes, listened to discussions upon rations for cattle, rotation of crops, and best methods for improving breeds of plants and animals. Women as well as men have learned to think in terms of protein, carbohydrate and fat. They understand bacterial action in the soil and in the cultures from cream; they have learned the life history of aphids and the San José scale; they have studied the laws governing the breeding of plants and animals. What other class of women than farmers' wives is more nearly ready to study intelligently rations for men, the health of the household as determined by knowledge of infection, the water supply and disposal of waste, and the conditions for a stronger race of men? All of these questions and many more come to the farm women more than to other women.

Improvements in farm machinery and equipment have arrived before household improvements. Men and women have together economized to buy more acres, more stock and more farm implements. The household side has been forgotten and women have learned how not to spend money instead of how to contrive to make the kitchen a workshop run on truly economic principles. The experience and mechanical skill of men are needed to make healthful and convenient houses. Their business ability is needed to discover

that a woman's time and strength are capital whether she is paid a wage or not.

Traditions and present conditions do not square up. Old ideals must be given up. The activities and interests of women are extending. Woman's education must be accommodated to our present needs. The education of girls now has a double aspect. She is a homemaker in the old sense and is widely becoming an industrial worker.

There is more and more need that women know the household arts. Women need to learn what to eliminate from the home, and determine whether they are doing there what could be done better elsewhere. Otherwise there is useless labor. Woman is becoming an industrial worker alongside of her brother and husband. A great amount of work is given to the factory which was once done in the home. There is smaller chance therefore for an income to-day in the home. Neither man nor woman can compete with the machine. If women enter men's work shorter hours for all must result, otherwise there are lower standards. At the same time there is danger of neglect of work properly given to women for the nurishment and care of her family. The problem still confronting her is whether the food is properly cooked and served with sufficient variety and proper selection, whether there are healthful sanitary conditions for the proper efficiency of the family and the problems of household construction, decoration and furnishing. For these she needs training.

Every rural community has its group of young women asking what is in store for them and its group of older women asking how with scarcity of help they can accomplish all their tasks. Some of the young women are stirred to aspirations for teaching, stenography or factory life where they can get away from the humdrum and monotony of household routine. Others are fascinated by the opportunities of farming for women and others are staying at home because they are needed or have married their 'steady job.' These women have done much for the farming of the present and the future. They are executive. They have economized and they have listened attentively to ways and means of improving farm conditions. Farming in the meantime has been 'looking up.' Women are still executive, economical, striving for gain in the farm finances for the sake of more land and education for the children. Standards of living have been rising and the farm home has come to be regarded as a place where better conditions should prevail for the sake of the children and for the sake of the entire community whom the farmer feeds.

Men are asking that the youth be trained for farming and are trying to induce the young man to stay on the farm. They are asking for better and more permanent forms of agriculture that the people may be better and more cheaply fed. Training the farmer for his task is only half the problem. The woman on the farm is a vital part of the success of the place. The farm rises no higher than its women.

Women need education for their task as much as men. Men have long thought the 'rule of thumb' was good enough for the work in the house and the care of the family although they believed that scientific accuracy was needed for tilling and feeding out of doors.

Women need the inspiration and uplook of intelligent service, of scientific methods, of artistic accomplishment in even very practical affairs.

Much is said about the improvement of the raw material. What is the use of it all if women are not trained for the selection and preparation of the raw material?

Housekeeping is behind the times. The house has the poorest workshop of any industry in existence. Here is needed the co-operation of men. The same masculine inventive genius which brought water to the barn is needed to bring it to the house; to attach the same power to the washing machine which is used on his saw or threshing machine. Men have carried a certain business calculation into their farming which prevents their using worn-out, out-of-date tools and equipment; the same business thrift should prevent unhandy conditions in the kitchen, and lack of labor saving devices. Farmers do not want their sons to work in the way they and their fathers worked. Neither can they afford to allow their wives and daughters to work under such disadvantages as the old-time kitchen presented.

Millions of dollars are spent in the United States every year for domestic service. This includes large amounts not only for wages but for waste and for food. Until this amount is safeguarded by training and intelligence, wasted effort and wasted material contribute to the high cost of living.

We recognize the fact that the men who are working in the institutes are doing a splendid work in teaching the adult people of the country. In your institutes there are young men and young women needing inspiration, direction, incentive. We want more intelligent men and women in the homes. Better conditions will prevail to prevent women from feeling that they are machines, goods or chattels; they must believe they are a part of the economy of the household and a progressive part. Institutes should help girls to feel that they should have an exalted attitude towards housework and their positions as wives and mothers.

If a man or woman went out to institutes this year and feels that he inspired his neighbors for higher ideals and for better conditions he has done more than to earn his salary.

SOME THINGS OUTSIDE THE FARMYARD GATE

By FRED W. CARD, *Sylvania, Pa.*

All Institute Lecturers realize, yet are sometimes prone to forget, that the production of crops and the making of money is not all there is of farming. These, while important, represent only one phase of successful agriculture. Most of us agree, therefore, that some things aside from these ought to be discussed on the insti-

*Hon. James Foust, Dairy and Food Commissioner of the Commonwealth of Pennsylvania, was to have delivered the first address of the morning on the subject of "Difficulties Encountered in Enforcing The Pure Food Laws," but was prevented by press of official duties from attending the Institute.

tute platform. For this reason I have been taking up in one of my topics some things which come to the farmer as a duty. Some of these duties come to him as a farmer in his relationship to other farmers; some of them come to him as a citizen in his relationship to his fellow-men. He has no right to shirk these duties. Their number is great. I shall mention but a few of them.

First, though not most important, it is his duty to interest himself in the subject of farmers' organizations. These are of various classes but I will mention first co-operative organizations. These may take different forms; first, that of co-operative production, representing in many phases, from the simple ownership of an implement or a sire by two neighbors to the co-operative company which owns a creamery or a canning factory. The result of these organizations has not always been satisfactory, sometimes due to one cause, sometimes to another; but often, in the case of creameries and canning factories, the plant has been established at the solicitation of a promoter concerned not with the success of the undertaking but with securing the greatest possible price for the equipment furnished. At other times failure has resulted through the lack of good business management. When established on a proper financial basis, with men of good business sense in control, the results have usually been good.

A second form of co-operative organizations is represented by co-operative selling, best illustrated perhaps by the first-shipping associations of the far West. This form of organization is less important to us in the Eastern states owing to our closer proximity to markets and the better opportunities offered for individual sales. Yet this brings us face to face with the great problem of distribution, one which has called for more attention than it has yet received from farmers and those interested in agricultural welfare. One of our leading agricultural journals has for some time been discussing this matter and has arrived at the conclusion that under average conditions the farmer receives about 35 cents out of the dollar which the consumer pays for his products, the remainder going to the carrier and the handler. Recently President Yoakum, of the Frisco Lines, in discussing these problems, has cited some definite instances which serve well as illustrations. He says that the Florida truck grower receives $2.25 for a crate of beans; the railroad receives 50 cents for the 800 mile haul to the New York market; the dealers receive $3.65 and the consumer pays $6.40. In other words 35 per cent of this price goes to the grower, 8 per cent. to the railroad and 57 per cent. to the dealer. Is this distribution equitable? During the last winter eggs have sold in Arkansas and Missouri for 15 cents a dozen; freight to New York is 2 cents a dozen. The consumer pays 30 cents for the eggs and the dealer receives 13 cents of that amount. The rice farmer of the Gulf states receives 2½ cents a pound for his rice; the railroad receives ½ cent for the haul to New York; the dealer receives 7 cents a pound for handling and the consumer pays 10 cents a pound. These may be exceptional illustrations, yet they represent in a general way conditions as they exist. The middleman is a necessary part of modern business; he cannot be eliminated, yet the problem of a more equitable distribution of returns needs study and solution.

A third form of co-operative organization is represented by co-operative buying. Any grange, fruit-growers' association or other organization, by working together, can save its members considerable money by buying fertilizers, seeds, spraying materials and similar supplies together. I know of one grange in a potato-growing region which for years has bought its seed potatoes from Maine by the car load and had its fertilizers mixed according to its own formula by the fertilizer firm which would give the best bid with a sufficient guarantee of the product.

The most prominent farmers' organization at the present day is the Grange. Its aims and purposes are too well known to need discussion. We are likely to forget the good which it has accomplished for farming interests, yet its possibilities lie far in advance of what it has already done.

It is the duty of the farmer to interest himself in questions of public policy, questions which may influence him chiefly or which may influence other members of the community equally. First among these I will mention good roads. This is a question of paramount importance to the farmer, despite the problem of the automobile which is now undergoing solution. The farm which has between it and the market a hill with a grade of 8 to 10 feet in the hundred, or a piece of swampy road which may be nearly impasable at seasons of the year, is worth many per cent. less than a farm of equal productiveness more favorably situated. The weight of load which can be hauled is determined by the steepest or poorest point in that road, not by its average condition. What the solution of this road problem should be I am not wise enough to say. I am not at all sure that the most promising line is in seeking appropriations for disconnected patches of State road here and there, built at excessive cost, for the accommodation of certain communities and certain legislators who wish to please their constituents. I believe that this problem needs careful, systematic study by men trained for that purpose, men who should be able to devise methods of building country roads at reasonable cost which, while not equal to the macadamized roads, shall greatly improve our present ones. The bad location of many of our roads is one of their worst features, yet even this could often be changed at far less expense than the making of State roads. Thorough drainage alone would do much to solve this problem.

Not all communities need to interest themselves especially in the problem of the rural telephone, yet I find many localities in the State which are not yet served as they should be in this respect. Unfortunately it is not easy to establish an independent line where corporation lines already are in the field, but undoubtedly this is the method which will give best returns for the farmers' money. As an illustration, let me mention the company in our own locality. I well remember when this movement was started. Small in its beginning working to us from the westward, farmers were allowed to furnish poles or work in part payment for their stock and no man was allowed to own more than three shares of stock, thereby guarding against monopoly. At the present time this company is represented by nearly 1,200 stockholders, with half as many renters, and owns about 2,000 miles of wire. There is scarcely a farm in the region but can be reached by 'phone. The expense at the present

time, to stockholders owning their own 'phones, is $4.00 a year, an increase of $1.00 over previous years. The benefits can only be realized by those who enjoy them.

Freight-carrying trolleys are badly needed throughout many of our farming communities. Unfortunately these come most rapidly in most densely populated localities. These must be largely the result of growth and time, but any action favoring the establishment of such lines should be considered the duty of every farmer.

The means of communication of greatest importance to the farmer at the present time would be obtained by the establishment of the parcels post. Any farmer who wishes to reach a distant customer with a pail of butter or case of eggs knows that 25 cents is the least possible express charge, with rates rapidly increasing with distance or transfer from one company to another. The German farmer may send a 10-lb. pail of butter anywhere within a distance of 46 miles or less for 6 cents, or anywhere within the limits of Germany and Austria for 12 cents.

Several years ago a gentleman presented a suit case at the post office window in New York City, stating that he wished to mail it to New Haven. He was soon troubled to find that he must tell the contents of the case, although he could not see why that made any difference in the cost of its carriage. If it contained magazines he must further tell the postal clerk his business, for if he were a private individual sending those magazines to another private individual he should pay 4 cents a pound. If he were a printer sending them to a publisher he should pay 8 cents a pound. If he were a publisher sending them to the newsdealer he might send them for 1 cent a pound. If they chanced to have a board cover on them, making them a book, he must pay 8 cents a pound. If he chanced to be a farmer and had in that suit case potatoes or corn he must tell what he intended to do with them. If he meant to plant these things he might send them for 8 cents a pound but if he intended to eat them he must pay 16 cents a pound. Furthermore, he must give up the key to the government. He did not realize that is was the purpose of the postal authorities to act as detectives where no intent of misdemeanor was apparent. Upon inquiry he found that he might send this suit case to New Zealand and back to New Haven for $2.64 or by way of Germany for $1.95; but he did not care to wait that long so decided to mail it direct. However, it exceeded 4 pounds in weight, therefore he could send it at none of these rates but must pay letter postage. It was mailed at 5.30 p. m., and delivered at 10.47 p. m., at a cost of $3.68. It could have been mailed from any point in Germany to the same destination for 63 cents or to any point within Germany, as above stated for 12 cents.

The express companies are ready to interpose objections, voiced by Congressmen, to the establishment of parcels post. They say that our country is too big; we cannot do what the smaller countries of Europe can do. If so, why not limit the distance as in Germany, with a higher rate for the greater distance. They point to our present postal deficit and say we cannot afford to increase this deficit. Some light is shown upon this problem by the report of the Canadian Postal Department for the year ending March 31, 1909. During that year the mail carrying mileage of Canada in-

creased over 1,000,000 miles, entailing an additional cost of nearly $600,000. During the same year the drop letter rate in cities having carrier service was reduced from 2 cents to 1 cent and the postal rate on bi-weekly and monthly publications placed at a uniform rate of ½ cent a pound, just one-fourth what is paid in our country, yet the Canadian Postal Department showed a surplus of nearly $1,000,000 for that year.

A recent writer states that he had been an assistant postmaster in Wisconsin for nearly 27 years, under five postmasters, and that with a single exception, and that for only a short time, not one of these postmasters ever had so much as a chair or desk in the office or ever knew anything about its management; that the work was done by paying an assistant postmaster one-half the salary received by the postmaster. Why not cut out these sinecure postmasterships and help reduce that deficit? Then put the weighing and payment to railroads on an equitable basis; in short, put good business methods into our postal management, and this deficit would soon disappear. There are some 40,000 rural delivery wagons traveling the roads of our country, each one carrying less than one-fourth of a load. Give us the parcels post and these carriers something to haul and the postal deficit will look out for itself.

It is argued that the country merchant opposes the parcels post on the ground that he cannot then compete with the great mail order houses of the cities. Last year I grew a few potatoes on a dry hillside among young trees. No rain fell and the plants stood still. At harvest time the potatoes were few and small. The cost was high. If I took them to our country store-keeper and tell him these conditions, saying that I can not compete in price with the grower who found conditions more favorable and that he should pay me $1.00 per bushel instead of 30 cents or 40 cents which he may be paying, what will his answer be? If he tells me that he cannot buy and sell merchandise as cheaply as a man 500 miles away in a distant state with excessive rents and clerk hire to pay, what answer have I a right to give? But I believe this objection is groundless. It often happens that for the need of some small article which cannot be had at the country store, or upon which the price asked is excessive, the farmer makes up an order of sufficient size to warrant a freight shipment, sending it to a mail order house, when if he could have had the one article sent at reasonable cost by parcels post he would have limited his order to that and bought the rest from the home store. Just so long as we permit corporate interests to dominate this question just so long will we do without this needed reform. It is time that we speak in no uncertain language and demand this right.

Few of us feel that we know much about the tariff, and sometimes we wonder, when we think of the recent debate on this subject in Congress, whether any one knows much about it. If we have arrived at any conclusion I think it has been that this matter ought no longer to be the football of party politics or the grab bag of private interests; that it ought to be removed entirely from political manipulation and turned over to a commission of men trained by study and experience to arrive at just and equitable conclusions. In other words, that there ought to be a tariff commission which should settle the question of duties upon imported goods.

Many questions of minor importance along these lines are worthy of consideration, among which may be mentioned that of land tenure. There is no reason for our present cumbersome, expensive and uncertain system of land transfer. The Torrens system would do away with all this, making the transfer of land safe and simple.

Another question of prime import upon which each one of us should make our views and influence felt is that of economy and integrity in public administration. There is no good reason why one system of business management or one system of morals should prevail in private affairs and another system in public affairs. There has been and still is too much laxity in this matter. We need to demand better service from public men and better business methods in the management of public affairs. Closely interwoven with this is the whole subject of taxation and the problem of its equitable adjustment.

Another grave problem which interests every farmer is that of the general status of agriculture in America. What is to be the future of the American farmer? Essentially he has been in the past a middle-class man, a balance wheel for the nation. Farmers there are, to besure, who fall far below this estimate but as a class this is where we expect to find him. Shall he continue to occupy this position? The history of many of the older countries of the world does not afford a promising outlook. Too often has the tiller of the soil sunk to the level of a tenant or even to that of the peasant. A problem of this sort is not to be solved by any offhand remedy or suggestion. It is one which will demand time and study, but one which is worthy of the best thought of the men and women who have at heart the welfare of American agriculture.

No farmer can afford to neglect the social life of the community. Too often he does neglect it and suffers the result. Man is a social being. He demands more than food and drink. Social intercourse contributes both to enjoyment and to business success. Country life does not favor it. It therefore comes upon us as a duty to give some thought to this phase of life.

Every man, whether farmer, mechanic, merchant or lawyer, owes a duty to the public school. This duty unfortunately most of us shirk. But the problem of the rural school is facing us today in such a way that we cannot afford to neglect it. We are proud of the men and women engaged in educational work, and prouder yet of the pupils within these schools; yet we have the right to ask whether our school system has done in the past what it ought to do for the country child. I think our answer must be that while it has done much it might have done more. Long have we bewailed the movement from country to city, yet what can we expect when all the work of the school points only in that direction. I am not among those who expect much in the teaching of agriculture in the common schools which will enable the boy to become a better farmer or in the teaching of domestic science which shall enable the girl to become a better housewife, but I believe we have the right to ask of these schools that they shall help us to maintain in the mind of the child an interest in the affairs of the farm and home. We need a type of education more closely in touch with the future life work of the child. It matters less whether that instruction be of the highest type possible than it does that it shall be of some type which

shall show to the child the possibilities along these lines. Mistakes will be made as mistakes have been made in the past. Educators, in their zeal for agricultural, industrial and domestic education, will be prone to introduce into the school many things which could be better taught in the home and on the farm. We shall need to exercise an oversight and bring our judgment to bear in these problems. There is no lack of opportunity for usefulness for the educated farmer and farmer's wife in connection with this public problem.

So, too, it is the duty of every man to lend his aid to the church. I care not whether you are a member of this or that church or indeed of any church, you cannot afford to neglect the things for which the church as a whole stands for. Sweep from our present civilization the things which have been the outgrowth directly and indirectly of church life and activity and little would be left which makes life best worth living. Unquestionably the country church has had in recent years a hard struggle. It has lost some of its oldtime influence. It faces the need of a readjustment in its methods and obligations. It needs the help of every earnest man and woman within the sphere of its influence. I believe the church should be in closer touch with the affairs of the community in which it is located; in other words, with the farmer and the home. I count it a most encouraging sign of recent times that one of our agricultural colleges has established a summer school for the teaching of agriculture to ministers. I shall not be surprised to see in the near future the establishment of agricultural courses in our theological seminaries, for I believe that the minister who is to render the greatest service and be of most help to his people in the country community is to be a man who understands agriculture and knows the problems and perplexities of the farmer and the farmer's home. There is greater need that the country church should be a social center for the community than in the case of the city church. Institutional churches have been established in cities in which libraries, game rooms, gymnasiums and similar facilities exist. There is greater need for those things in connection with the country church, though the problem of securing them is far more difficult. I wish the day might come when every country community could possess such a church. Personally I would have in that church some things which perhaps might shock the sensibilities of some good people but which nevertheless I believe would contribute to the moral and spiritual welfare of the young people of the community.

Thus far I have dwelt entirely upon the duties facing the American farmer, but there come to him privileges as well, though, as I look these over it seems to me that most of them lie within the farmyard gate rather than without it. There is no bar to the passage of good literature and good books of all sorts through this gateway. The cost is little and every farm home has open to it boundless possibilities along this line, the companionship of the noblest men and women which the world has produced, at their best moments. Music, perhaps not of the most fashionable or approved type, but music which shall enliven and upbuild human life may be found therein. Art, too, may find its place there. Good pictures are not expensive. Better yet, there lies spread before the farmhouse window landscape pictures unequalled by any artist's brush, pictures chang-

ing from day to day from month to month, pictures which shall bring rest and inspiration to all who will stop to look and drink in their beauty. Nature in all its manifestations is before the farmer and his family at every turn. Let him pause to read her message and listen to her language. In the evolution of plants and animals going on before his eyes may be seen a glimpse of creation taking place at a far more rapid pace than in any wild plants and animals. Then, too, comes the inspiring thought that some measure of this creation is being given over into his own hands in the shaping and developing of these forms and types. Here he may catch whispers of the Divine Voice or read a message of Divine Revelation given to man today in a language ever fresh and ever new.

Let no farmer shirk these duties nor become so absorbed in his pursuit of dollars that he fails to avail himself of these privileges.

HOW TO RAISE CROPS WITHOUT WEEDS

By DR. J. D. DETRICH, *Scranton, Pa.*

The first to grow on a farm and the last to talk about on a program at an agricultural Institute are weeds. Admitting with all fellow-farmers, that weeds are universal nuisances, yea, robbers of plant food and heavy drinkers of film water, depriving growing crops of both, necessitates a greater need for their suppression if not entire eradication in farm practice. To say that land can be put into such a high state of fertility that weeds will not grow is a wrong conception of soil and its nature. Yet without every inch of soil is tillable and in a loose friable condition, also in position for the operation of modern farm implements and machines to cut, plow and stir the top soil, weeds will occupy the poorer as well as the best land. Fences on farms are great weed harbors for their growth, ripening and propagation, since the plow, mowing machines or cultivator are prevented from destroying them owing to the fence being in the way. Trees, rocks, stone piles and stumps in fields alike obstruct implements and machines from putting a stop to weeds.

The edges of ponds, the banks of streams and open ditches likewise grow and mature weeds that reseed the land about them with their baneful influence. A farm free from as many of these favorable places for weeds to grow unmolested, is a part of farm management that can not afford to be overlooked, but strictly enforced season after season till all weed harbors are destroyed or brought under control.

Perhaps this whole subject of growing crops without weeds can in no way be made more intelligible than to cite an illustration where a farm was actually carried on and noted for its scarcity of weeds and at the same time remarkable for its fertility. The weed problem on this farm was satisfactorily solved by pure seed, thorough tillage, frequent cropping of maximum yields, thick seed-

ing never allowing weeds to seed by clipping with a mower when in bloom and the manuring of every principal crop with fresh stable manure.

Weeds were plenty on this farm before the radical changes in management and new methods were introduced. The first departure was to discontinue the old plan of a long rotation and instead of manuring once in four or five years with barnyard manure of doubtful value, to haul fresh stable manure of known worth and top dress grass itself. Along with this was practiced new methods of seeding certain crops; grass being one of these. To sow timothy with wheat at seeding and then add clover to the crop by sowing it on the wheat field in the following spring some time when the "sign was right," was wholly adandoned for the mixture of grass, such as clover, timothy, red top and alsike seeding these in the month of August at one sowing without a reverse crop of any kind. The reason for this change, if for no other, yet there are others, most weighty, was due to the following: If timothy is sown with wheat, the timothy seed runs into the same furrow or drill with the wheat. The hoes on a grain drill are never less than six inches apart, thus having a space six inches wide for weeds to grow and only a string-like groove for the wheat and timothy stalks. If clover is sown in the spring on this hard and weather beaten grain field depending on cracks for tillage there is much of it, if not all settles in the same grooves already occupied by the timothy and wheat so that the six inch space for weeds has not been encroached upon very much by the clover. When the wheat begins to grow also the clover and timothy in the spring, the weeds have full six inches of room on which to flourish and they do; they get an excellent start and keep it. Many of them are just high enough when the wheat is cut to miss the sickle of the machine. If they are not in bloom and many of them are not, if clipped, start afresh and grow with more vigor than ever. But many fall weeds ripen about the same time as the wheat such as garlic, cockle and other weeds harvested, stored and threshed with the grain. These if ground with the wheat into flour either discolor or give a very unpleasant taste to bread, and if they escape grinding are returned to the land per the manure or otherwise only to infest the field again.

It is very clear from what is only too common in experience that the old style of seeding grass with a reverse crop is a very fruitful source of weeds. Nor does the evil they affect on the wheat crop cease with it, but a still more serious result follows their presence in the hay crop that succeeds the wheat harvest. Nowhere do weeds appear in greater abundance, more varieties and more objectional than in the feeding value of hay. Their rank growth, towering height and woody stalks do not only appear above the timothy and clover but smother the growth of the valuable grasses and injure the feeding value of the roughage. Many weeds ripen their seeds before the timothy and clover are in bloom either to reseed the field, or are cut with the grass, cured with the hay and hauled to the barn stored away safely in the mows, to go through the livestock when fed like gun shot undigested, pass into the manure pile to reseed the land when the manure is spread on the fields. After hay hauling is finished and the barn floor swept, it is surprising to see the sorrel, plaintain, dock and other weed seeds that have shat-

tered in handling the hay. As long as such seeding is practiced on any farm land, rich or poor, weeds will increase instead of diminish, for no more effectual plan for perpetuating weeds could be devised.

The new plan adopted to obviate the propagation of weeds was to start preparing the land for grass about 18 months beforehand by turning a timothy sod free of weeds, well top-dressed, the previous fall or two years before the grass seeding with the best and cleanest fresh stable manure for a crop of ensilage corn.

The plowing of the sod carefully and well done turning up side down every furrow 12 inches wide—rolling followed, plowing never again, till the field was plowed for another crop. Harrowing began after rolling, using 3 different harrows to put the soil in the best condition at the least labor and cost. The field marked out so the corn would be in a furrow below the surface of the field when it first comes up. The third day after planting the weeder was run over the field, the fifth day the corn would be up, strong and bright, when it made its second or third leaf the weeder was put on again, but if it had rained and a crust was on the field too hard for the weeder to do any execution, the one-horse cultivator was spread just wide enough to go once between the rows of corn without attempting to mark or get close to the little stalks. The horse walked in the middle between the rows and the wheel of the cultivator followed in the horse's footprints. This plan broke the crust and left a fine mellow soil to be worked over into the corn rows without covering the plants but filling the groove or trough in which the corn was planted, covering the small weeds and killing millions not yet born. The next work the corn received was with the riding cultivator, going close to the corn followed in a day or two by the weeder and not a growing weed to be seen. The crop having arrived at this stage there was no trouble to salivate the weeds during the season by the dust mulch well stirred while growing to retain soil moisture.

When the crop was ready for the silo there were no weeds. The silo filled and the field clean the two-horse cultivator works up the corn stalk ground for seeding to rye as a cover crop to be turned by the plow in the early spring for oats and peas. This last named crop is the finest soil cleaner save that of buckwheat for freeing the land of weeds and is splendid to preceed the laying down of a field to grass in August.

To anyone interested in this method he is invited to observe the manner of preparation. First the timothy sod manured and prepared for corn; the surface of the corn field worked all summer, then hoe harrowed for seeding rye, plowed in the spring for oats and peas. Thus the land has had two plowings and one whole summer's surface work also prepared for the rye seeding by the cultivator, all this looking forward to a *clean grass* field, free from weeds by tillage together with the crop of peas and oats that in its dense growth will smother any weed that attempts to grow. The peas and oats stubble is then manured daily with fresh stable manure; this finished, the plow is set to cut deeper than for any other crop on the farm, rolled once and harrowed till the soil splashes when the feet of the team strike its surface in working. By this time there is a seed bed from 3½ to 4 inches deep in fine-

ness like dust, then a mixture of red clover, alsike timothy and red top is sown broadcast with a wheelbarrow seeder or any of the devices for the purpose and brushed in with the weeder, going over the field but once and only in one direction. The field is left in this condition till the next June when the mower cuts the crop for hay. After the first crop a second is cut, then a third, and very often a fourth, finishing making hay in October. Immediately fresh, wet, heavy stable manure mixed with short litter is spread daily over the sod till the piece of land is completely covered and left till the following June, when the growing timothy is without a weed, little or big standing, as thick as it can grow.

Having followed this plan of lessening if not entirely exterminating weeds by growing crops with the object in view of eradicating them by obtaining the largest crops and profits with no loss to the pocketbook. The method is extremely simple, raise as many and as heavy crops as possible to choke out the weeds, smother them, kick them out with the weeder, turn them under with the plow, cover them over with the cultivator, never let them go to seed, have no harboring places for them to propagate, never haul their seed in the manure to the field, and at the same time sow the best seed, remembering also the injunction "that he that soweth sparingly shall reap also sparingly." The whole subject of growing crops without weeds resolves itself into one conclusion, that of intensive farming must be caried out to the letter. No nostrums about it, only thoroughness in every department of crop growing.

ABSTRACT OF PROCEEDINGS OF THE SIXTH ANNUAL CONVENTION OF THE FRUIT GROWERS ASSOCIATION OF ADAMS COUNTY, HELD DECEMBER 14, 15 AND 16, 1910

OFFICERS

President, ... ROBERT M. ELDON, ... Aspers
1 *Vice President*, ... C. J. TYSON, ... Flora Dale
2 *Vice President*, ... C. A. GRIEST, ... Guernsey
3 *Vice President*, ... C. E. RAFFENSPERGER, ... Arendtsville
4 *Vice President*, ... E. P. GARRETTSON, ... Biglerville
5 *Vice President*, ... J. G. STOVER, M. D., ... Bendersville
Recording Secretary, ... JOSIAH W. PRICKETT, ... Biglerville
Corresponding Secretary, ... EDWIN C. TYSON, ... Flora Dale
Treasurer, ... WM. S. ADAMS, ... Aspers

EXECUTIVE COMMITTEE

ROBERT M. ELDON, ... Aspers
C. J. TYSON, ... Flora Dale
C. A. GRIEST, ... Guernsey
C. E. RAFFENSPERGER, ... Arendtsville
E. P. GARRETTSON, ... Biglerville
J. G. STOVER, M. D., ... Bendersville
JOSIAH W. PRICKETT, ... Biglerville
EDWIN C. TYSON, ... Flora Dale
WM. S. ADAMS, ... Aspers

PRESIDENT'S ADDRESS

By ROBT. M. ELDON, *Aspers, Pa.*

The problem of the Adams County Fruit Growers' Association is to hold each year a better convention. We shall be pleased indeed to do this during this week. There is no expectation of furnishing a program that shall be novel throughout or in large part, even if that were desirable, but new tailors for new clothes, may add interest to subjects which have been discussed more or less regularly since the growing of fruit was begun and discussions had. It will be, then, not so much the declarations of new methods as the perfection of old ones by addition of elimination. We are willing and anxious to hear the latest and best of everything from the planting of raw land to the receipt of returns for fruit marketed.

Can planting be overdone, and especially will planting in the East be overdone is a question which is frequently heard. Some say that it is now too late to plant trees; if they were now grown and ready to bear, all well and good, but by the time the new-planted ones are ready to bear in seven to eleven years the market will be overstocked. We certainly think that the year 1900 was a better year for planting than the year 1910, being first on the field is always a great advantage, but that there will be a good market for the good crops of the 1910 planted trees we also fully believe. Not everybody is planting trees or expects to do so, and many of the trees planted so lately as 1900 are dead as they can be. Certainly many of those planted earlier are gone. It is the exception to see even in Adams county a thrifty kitchen orchard or farmer's orchard.

One argument and a good strong one why the eastern orchards are going to succeed is that the best markets are within easy reach; are right at our doors, in fact. Observe the eightieth meridian passing through Pittsburg and Charleston and see what our eastern home markets are. East of this are to be found two of the greatest cities in the world; eight others, each with a population in excess of 250,000. Three of the eight have nearly 600,000 each. Of fifty American cities with 100,000 or more, almost the half are here. Of one hundred seventy-eight cities with less than 100,000 and more than 25,000 nearly the half are here. While the little cities and the big boroughs are too many to name. These great cities, these big cities and the lesser cities, boroughs and towns are not only here and are ours to supply, but the census reports also show that they grow, and are growing generally faster than those of the West and Middle West.

Let us plant more orchards and plan to keep them. We are the best placed geographically. Our land is relatively cheap, and there are no charges for water, and as to water control, all we need do is to plant the slopes and upland. The matter of irrigating the orchard requires the skill of the expert, and already there is something wrong with many of the western irrigated orchards. We are slower in production of crops but we will be here when the other fellow is out.

And while we have the whip hand on the western grower in the matter of haulage and freights yet the railways with the "short haul" and "long haul" idea are keeping in the way of our having reasonable freight rates, making up in part what they lose in distance by higher local rates. The express companies are their willing allies. We cannot send small packages of fruit by express profitably. If I send a single basket to Harrisburg it is the minimum charge of 35 cents. If I send it by the Adams Company, it is twice the minimum or the usual selling price of the product. I could not ship a large quantity of peaches by express to populous Rhode Island unless in a year of very high prices and make a profit. Let us use our congressmen in getting after the express companies by way of a parcels post. We possibly could not deliver fruit by mail but a general parcels post would work havoc with the present too high rate of the expressman.

We need a proper storage place for our increasing apple crops. As it is we now or very soon must sell from the orchard at the buy-

er's price, because the cold storage warehouse is either bought up in advance or is too far away. Can we not build a local plant and manage it locally? It would remove the necessity of selling at picking time. It would pay and would give to the grower a choice between selling and storing which is necessary to give him a fair share.

As to the Adams county crops this year, it might be said, that though it was what we call the "off year," it was about equal to the best previous full year crop. Whether the young trees now beginning to bear will drop into the apparently established habit of the old ones, or whether we shall cease to have an off year, will be interesting to note. Perhaps when we regularly thin the apples, regular annual cropping will be the rule.

Spraying is now generally practiced by the Adams county growers. To spray to kill the scale or to insure against its dangerous occurrence is now accepted as good orchard practice. While, heretofore spraying has been directed against scale to keep the tree alive, it will hereafter be particularly directed to the object of perfecting the crop. The problem will be to keep the foliage in perfect condition, to prevent scab, blight, rust and rot, to protect the foliage and fruit from the attacks of vermin that chew. We are already able to get good arsenicals, and let us hope that National legislation will shortly insure their quality. Let us hope that some formula of lime and sulphur will give to the orchardist a cheap and perfect summer spray.

The difficulties in the marketing of the year's apple crop keep us alive to the need of package legislation. Let us urge National enactment and let us hold firmly to the old-fashioned idea of making a measure a full measure; a bushel named, a bushel in fact. Doubtless the western grower will cling to the notion that a bushel box must be regulated by the size of Western apples, and the soon to be exploded idea that boxed aples are only grown in the West. If no National law is enacted in the near future, the Eastern states are certain to pass statutes regulating packages which will no doubt be difficult for the western grower to meet with the short boxes in vogue there. I hope that the Appalachian growers, as suggested by recent organizations in Virginia and New York, will not attempt legislation until harmony prevails throughout the East. With the program filled by men from all sections of the East, we should know before the close of this convention something of Eastern sentiment.

SOME SUGGESTIONS ABOUT THE MANAGEMENT OF ORCHARDS

By H. P. GOULD, *U. S. Dept. of Agriculture, Washington, D. C.*

In the management of orchards, we like to think we are progressive and modern in our methods and up-to-date, blazing the way along new trails. For quite a good many years now I have

been talking orchard management at horticultural society meetings and other similar places and I have been thinking all the time that I was advocating modern practices to meet modern conditions. However, listen to this: "But the misfortune is, that too frequently after orchards are planted and fenced, they have seldom any more care bestowed upon them. Boughs are allowed to hang dangling to the ground, their heads are so loaded with wood as to be almost impervious to sun and air, and they are left to be exhausted by moss and injured by cattle, etc."

Doesn't that sound very much like a description of some of the present day conditions? And again: "The feelings of a lover of improvement can scarcely be expressed on observing the almost universal inattention paid to the greater number of our orchards, and that people who go to considerable expense in planting and establishing them, afterwards leave them to the rude hand of nature; as if the art and ingenuity of man availed nothing, or that they merited no further care."

Verily, a repetition of much that is said about many orchards, of the present day. But if modern conditions are thus represented to any extent, somewhat ancient conditions are also portrayed in the language for it is thus that old Bernard McMahon wrote more than a hundred years ago in his "American Gardener's Calendar" which was published in 1806. It is interesting to note in passing that this is probably the first distinctly American book relating to gardening and fruit growing that was published in this country.

The statement I have quoted above therefore apparently represent common conditions with reference to the orchards at a very early day. Unfortunately such conditions have persisted to a greater or less extent to the present time. It necessarily follows then that there is nothing new or modern in the oft-repeated observations of the present day relative to our neglected orchards. There have been such orchards from the beginning and there doubtless will be such ones when the end of time comes.

I have been wondering a good deal lately what real progress we have made anyway in the management of orchards during the present period of rapid extension of the fruit industry.

Whatever other changes there have been, none are greater than the changes in the "point of view" regarding fruit production. And our present understanding of fundamental principles surely represents marked lines of advancement. Listen again to Bernard McMahon to show a contrast between some of the notions of a hundred years ago and present-day conceptions about the same thing: "When a tree has stood so long, that the leading roots have entered into the under strata, they are apt to draw a crude fluid which the organs of the more delicate fruit trees cannot convert into such balsamic juices as to produce fine fruit." Even if the orchards of Bernard McMahon's day were representative in many respects of the orchards of our own time, the undestanding of his time regarding the nutrition of the trees was indeed not the modern one. And we note a very marked advance towards what we believe is the truth when it comes to the matter of plant foods. Nearly 25 years later than the time when Bernard McMahon wrote—in 1829—Jethro Tull said, "It is agreed that all the following materials

contribute in some manner to the increase of plants, but it is disputed which of them is that very increase of food. 1. Nitre; 2, Water; 3, Air; 4, Fire; 5, Earth." Further on in his argument this ancient writer states apparently to his own satisfaction, that it is in reality earth that is the true food of plants. And he says: "Too much earth, or too fine, can never possibly be given to roots; for they never receive so much of it as to surfeit the plant, unless it be deprived of leaves, which, as lungs should purify it." His philosophy of tillage was that it made the earth sufficiently fine so that the roots could take up and assimilate its very minute particles. In other words, as he viewed it the roots of plants literally ate up the earth when it was made sufficiently fine for them to do so. And no doubt these views represented the best information and thought of the times 75 and 100 years ago.

But we want to turn now to some of the more living issues. What I have said thus far, however, is by way of stating that in talking about the management of orchards here to-day I have no new story to tell and I don't suppose there is any originality in the manner of presentation. But if I can aid any of you in better understanding the *why* of things, or if I can help you to gain a better "point of view"—a better way of looking at things, my coming here will perhaps have been worth while.

The more I study orchard management, however, and the more I try to tell about it, the more I think there is in it—in the telling—a strong similarity to trying to tell how to choose a wife or when to spank the small boy. I should like some intelligent advice regarding the latter proceeding, myself, but somehow the things that work well in other cases fail flatly in my own experiences. That is just the way it is in managing orchards. No rule-of-thumb methods can be applied. What is good in one case is not necessarily good in another because of differences in conditions.

Right at the very outstart there are a number of important considerations in which great numbers of fruit growers fail. The American propensity for doing big things is at the bottom of one of the commonest failures and that is in planting too large orchards. The fruit growers of this country have become so fully imbued with the idea of quantity that in great numbers of cases he has lost sight of quality. Where this has occurred the grower, the consumer and the fruit industry have suffered. An orchard is too large when its extent precludes the possibility of applying intensive methods of management.

The average American fruit grower has been slow to learn the fact that quality of product should dominate every other consideration in fruit production; that just as soon as quality is sacrificed to quantity or to any other thing, all the interests concerned are made to suffer thereby.

In many cases of over-sized orchards the grower realizes that something is the trouble, but he fails to comprehend just where it lies. Or if he does understand it, he hasn't the nerve to apply the remedy. Within the past few years certain sections in some of the Rocky Mountain and Pacific Coast states have become world-wide famous for their apples and other fruits. This fame has been built up largely on three practices; the intensive management of small

individual orchards; the most skillful and business-like-methods of marketing the fruit, thus making a reputation which is an actual cash asset; the united efforts of all parties interested including fruit growers, commercial clubs or other business organizations, railroads and other agencies, not the least of which has been the real estate agent in everlastingly booming and advertising the particular sections in which they were interested—and then keeping forever at it. By these methods any good locality for the production of fruit may make a reputation which will be known wherever fruit is eaten. In some cases, however, so much noise about a locality or region has been unfortunate for it has been overdone.

Many of these western sections to which I refer and which are now known the country over, would be entirely unknown—some of them not even on the map—were it not for the application of just these methods I have named.

In the Grand Valley of Colorado there are relatively very few orchards of ten acres in extent; in the Hood River section of Oregon the same thing is true and it is freely admitted in that section that their success has come from the intensive management of small orchards—to which should be added, and it is no small factor, co-operative methods of marketing their fruit. But the size of an orchard, it should be added, ought to be measured by the size of the man back of it, not by a surveyor's chain.

Now to touch upon more concrete matters, there are one or two things I went to say about orchard locations, for there are many orchards throughout the country that can never be made successful because their location is so faulty. Not infrequently orchards are planted on a site that looks well but if the subsoil is examined a solid ledge of rock will be found perhaps three or four feet below the surface. Where this condition occurs an orchard is an impossibility under most conditions.

A more serious matter, however, because it is more common, is a location that is faulty from the standpoint of atmospheric drainage. The importance of a location having good air drainage has been made very emphatic in almost countless instances during the past few years. You know how cold air will settle to the lower frost in low places and none at all in elevated places. This simply means that the cold air which is heavier than warm air has settled to the low places crowding the warmer air up to a higher stratum. The result is the killing frost observed on low ground and the absence of it on high ground.

Practical demonstrations of the bearing which this has on successful fruit growing have been many times repeated during the past few years in the good crop of fruit on high ground and in the same localities their destruction by late spring frosts.

But I want to discuss very briefly some of the fundamental operations that make up "orchard management." We think of orchard management as consisting of cultivation, fertilizing, pruning, spraying, etc., and perhaps we may come to add heating or smudging and other corresponding operations. But orchard management is really more than these things so far as results go for in the handling of every orchard there goes into it the individuality of the grower or manager—the "personal equation" and that is a most important

factor in the behavior and success of every orchard. I am coming to put more and more importance upon "the man behind the tree." A man's orchard reflects his personality.

Taking up now some of these fundamental orchard operations, we perhaps may ask first of all: Shall we cultivate or shall we not cultivate? That is a very important question. Its correct answer all depends upon conditions. The man who believes in tillage says "cultivate." The advocate of the sod mulch method says "No cultivation" and there you are! Both may be right, both may be wrong; each one may be right and each one wrong part of the time. It all depends! It frequently is the case, however, that neither one knows just what he is accomplishing in terms of actual and ultimate results by the particular method he has adopted or is advocating. If he happens to be giving thorough cultivation, this is about what he is accomplishing by the operation: (1) improving the physical condition of the land; (2) conserving the soil moisture; (3) increasing the chemical activities of the soil.

The influence of tillage has been very adequately set forth by Prof. Bailey. I cannot do better than to quote him in this connection:

"1. Tillage improves the physical condition of the land.
   (a) By fining the soil, and thereby presenting greater feeding surface to the roots;
   (b). By increasing the depth of the soil, and thereby giving a greater foraging and root-hold area to the plant;
   (c) By warming and drying the soil in spring.
   (d) By reducing the extremes of temperature and moisture.
2. Tillage may save moisture,
   (e) By increasing the water-holding capacity of the soil;
   (f) By checking evaporation.
3. Tillage may augment chemical activities,
   (g) By aiding in setting free plant-food;
   (h) By promoting nitrification;
   (i) By hastening the decomposition of organic matter;
   (j) By extending these agencies (g, h, i) to greater depths of the soil."

To these effects of tillage there may also be added a secondary influence, namely the maintenance of the surface of the soil in such condition that it will readily absorb the water that falls on it as rain, thus reducing the "run-off" or surface drainage to a minimum.

It is probably within conservative bounds to say that the vast majority of orchards require, in the average season, for maximum results, all the benefits enumerated that can be supplied or enhanced by tillage.

But I suppose the advocate of the sod mulch system claims that he is accomplishing the same thing by his methods. It should be observed, however, thus early in the discussion that a great many who claim to practice the sod mulch system are doing nothing of the kind. They are simply not cultivating. They may even be harvesting a crop of hay from their orchards. But because it is in sod and they are not cultivating it—that to them is the sod mulch method. The sod mulch method implies a mulch—not a crop of hay. Of course there may be both but more often one of these things is at the expense of the other. You cannot use the grass that grows in an orchard for hay and leave it on the ground at the same time to decay and enrich the soil.

The sod mulch system, means that there must be a mulch. As practiced by those who are the most consistent in the matter, the grass that the sod produces is allowed to lie on the ground where it falls, or in the case of young orchards perhaps it is gathered from the excessive heat of summer, and, in time, to decay and become more or less under the trees, to serve as a mulch to protect the soil incorporated into it. Commonly the grass is cut two or three times during the season, especially if it is making an abundant growth. Frequently it is the case, especially after an orchard has reached considerable age and the ground becomes much shaded thereby, that there is not sufficient grass grown in it to supply an adequate mulch. What does he do in that case? If he is consistently following this system, he mulches his orchard without fail. But he hauls straw and other similar material into the orchard to accomplish the purpose. This may seem more or less visionary to some but the practice is a reality all the same.

The effects of tillage have already been enumerated. What of the sod mulch system—what is that accomplishing in comparison with tillage? Well, the mulch doubtless conserves the moisture to some extent so far as its evaporation from the soil is concerned because it serves as a covering for the soil if it is properly maintained. But on the other hand, granting that the mulch consists entirely of the grass grown in the orchard, the fact that it requires a vast amount of moisture to grow it should not be overlooked. In many cases this moisture might better be conserved for use of the trees. Then too, the mulch as it decays, works down to the surface of the soil through the grass stubble and becomes more or less incorporated into the surface, but it cannot be that the influence of its ameliorating effect extends into the soil to any considerable depth. Of course there is more or less decay of the fine hairy roots of the grass each year and in this way humus is added to a slight extent. But when we contrast the two methods—tillage and sod mulch—their influence so far as soil conditions are concerned appear more by contrast than they do in comparison one with the other.

No one would think of growing corn or potatoes or pumpkins in sod. So far as the philosophy of tillage is concerned, if it is good for corn or pumpkins, it is also good for apples. There are no essential differences between trees and the annual crops in the manner in which they live and grow. Experience, I think, fully demonstrates that this reasoning is sound; that tillage should be the rule and that when variations from the rule are made, it should be the sod mulch method that becomes the exceptional one.

It is true that many orchards which are given the sod mulch treatment, or even orchards used as hay fields, if you please, are measurably successful. But where such success appears to be marked and perhaps appears to completely vindicate the wisdom of the practice, it should not be forgotten that the measure of success that obtains may be in *spite* of the method rather than because of it. It is often surprising how much hard treatment a tree will withstand and still reward its owner with a crop of fruit!

Before leaving this matter of the sod mulch, however, I wish to add that it does, beyond any doubt whatever, have its place in fruit growing, especially in the case of apples and pears. With the

latter, on account of blight, a rather slow, firm growth is desirable in contrast to a rapid succulent growth. The influences of tillage may easily induce the latter. And with apples, it does not necessarily follow that seeding the orchard down for a year or two at a time when cultivation is the rule is not oftentimes of direct benefit. The thing to do is to cultivate for the sake of the trees, not for the sake of the cultivation and when the trees by their appearance and behavior cry "enough," then seed down for a year or two to clover or grass of some kind. Fortunate, indeed, is the man who is so expert at interpreting the appearance and behavior of his trees that he knows when to cultivate and when not to do so. But this constitutes one of the fundamental differences between fruit growers. Then, too, the topography of many sites well suited otherwise to fruit growing is such that continuous tillage is out of the question on account of the washing of the soil which would follow that practice. In such cases the benefits of tillage which might otherwise result advantageously must of course be foregone for obvious reasons.

But continuous tillage of an orchard year after year—that thorough tillage which means clean cultivation—will gradually work ruin to the physical condition of any soil because it means a continuous diminution in the supply of humus or decaying vegetable matter which is absolutely essential to its fertility. Clean tillage then must be accompanied more or less frequently with a green manure crop. Fruit growers and others have been slow to realize or to understand the importance of maintaining the humus supply of the soil. But gradually it is becoming appreciated. All over the country, even in the prairie sections where the exhaustless richness of the soil has been the boast for years past, the necessity of growing green manure crops is becoming apparent and the fruit growers are seeing its meaning.

As a rule some legume is desirable for a cover crop because of the nitrogen which it takes from the air and adds to the soil. In a cow pea country, perhaps, there is nothing better than this crop; but crimson clover, common red clover, vetch, etc., are frequently used. Among the non-leguminous crops used, rye is perhaps the most common. Buckwheat, rape and various other things are also of value.

These cover crops permit of tillage through the most important portion of the growing season, then following the cessation of that, perhaps in July, the cover or green manure crop is sowed.

Thorough tillage and the use of leguminous cover crops go a long way in maintaining the fertility of the soil in an orchard. Further than this I am inclined to pass over the matter of the plant food supply for the orchard. But I have ample justification in so doing for two reasons: Your own Agricultural Experiment Station is doing more in the investigation of these problems than any other institution that I know about. Preliminary results have already been published and are available in bulletins from your station. Then, too, enough has already been said to show that the "fertility question" of any orchard is a very local question and the only place it can be answered for any one of you is right in your own orchard. The bulletins of your station suggest how to go

about answering such questions for yourselves. I therefore pass to the next fundamental tenet of orchard management—pruning.

Relatively, few orchards the country over, are properly pruned. In fact, a surprisingly large number are not pruned at all. It will help at the outset to have clearly in mind some of the more important reasons for pruning. They may be stated as follows:

1. To keep the trees shapely and within bounds.
2. To remove dead or interfering branches.
3. To make trees more stocky.
4. To thin the fruit.
5. To open the tree tops to admit air and sunlight.
6. To make thorough spraying possible.
7. To facilitate harvesting.
8. To reduce the struggle for existence in the tree tops.
9. To produce more fruit of better quality.

With this enumeration of the reasons for pruning I do not know that very much more need be said, though each reason given of course might be considerably amplified. If the truths contained in the several captions given are self-evident, as most of them must be, to take time to comment about them is to uselessly multiply words.

If a word of explanation is needed at all, it is in regard to Caption 8. Perhaps few realize that there is a struggle for existence going on in the top of a crowded tree top but such is the case. The fingers of one's hand are about as close together as they can well be but they are not in the way of one another and there is no struggle or competition going on among them for room or for food supply. Each has its own allotted amount which is sufficient. If one suffers for lack of nourishment or in any other way, all the others suffer with it. Not so in a dense tree top! Every limb and branch is competing with every other limb and branch, every bud with every other bud for room and sunlight and air and food. Often the struggle in this competition becomes so sharp that whole limbs die for lack of room and sunlight and plant food. The competition is a merciless one. Now if we keep the tops sufficiently thinned out, all is peace. There is no struggle to the death and as a result every bud has food enough to deposit within its folds a goodly supply besides making its normal growth; we have a well-fed tree and fruit buds strong and vigorous enough to withstand many vicissitudes of climate that would kill outright weaker buds.

To make such a discussion as this complete of course it should include some reference to spraying but you have wisely provided for that as a subject by itself for discussion, hence it calls for no comments here, only to say that the developments in spray mixtures during the past two or three years mark an advance in orchard practice which perhaps means more to the fruit industry than anything else that has occurred since the value of fungicides and insecticides became fully recognized.

Another advance step which I believe will eventually be grouped with cultivation, pruning, spraying, etc., as an orchard practice is orchard heating or smudging to prevent frost injury. Great

interest has been developed in this connection, many kinds of apparatus have been devised as means of applying or generating the requisite heat and smoke. While the practice must still be regarded as in the experimental stage, material progress has been made towards perfecting devices. When we know more about the range of possibilities and methods of working, it will doubtless be possible to formulate fairly definite plans of procedure.

It is now time to say that the production of good fruit does not consist in the tillage of the orchard, as important as that may be, or in fertilizing the soil well, nor in pruning, spraying, smudging, etc. But it does consist, other things being equal, in all of these various operations properly timed and adjusted to each other. Each one has its relationships to all others a break at any point in these relationships and a poorer grade of fruit is the result.

I am not supposed to say anything about the handling of fruit in the present connection, yet there is a pretty close connection between the production of it and its handling. There are only one or two observations that I care to make about fruit handling, and they are based on some of the experiences of some of my co-workers in the Department of Agriculture who have been working in California in connection with the fruit transportation and storage investigations of the Bureau of Plant Industry.

Four or five years ago the losses due to the decay of oranges in transit from California had reached such an enormous amount that it became alarming. The loss was variously estimated at from seven hundred and fifty thousand dollars to one million five hundred thousand dollars. The Bureau of Plant Industry of the Department of Agriculture undertook an investigation of the cause of this decay and the remedies. To make a long story, with many details, short, the chief cause of the whole trouble lay in the mechanical injuries which the fruit received while being handled between the time it was taken from the tree and the time when it was packed ready for shipment.

The solution of the problem has been largely a thorough reorganization of methods of handling with a view to reducing to a minimum the mechanical injuries to the fruit. My reference to this matter is made because it touches upon one of the fundamentals of success. The careful handling of all fruit not intended for immediate consumption is a "permanent issue" among fruit growers and others who may be concerned. A fruit is a living organism. It breathes; it gives off carbon dioxide; it lives and dies and then decays. Any sort of treatment which in any way destroys or injuries the cells of which a fruit is composed hastens its death and, by so much, induces decay.

In some cases it has been demonstrated that the mere dropping of an orange no more than twenty inches onto a hard floor results in a very material increase in decay in comparison with other fruit handled in identically the same way save for the dropping.

Of course the handling of citrus fruit as such, does not interest you in any way but if you grasp the principle involved you will see that the matter of extreme care in handling is not one of importance merely with citrus fruits but that it holds good for all fruits.

Now if in bringing my already too long discussion to a close there is one thing more than another that I wish to say it is to refer very briefly to the matter of co-operation among fruit growers. Almost every line of human effort is ahead of the farmer in having its co-operative organization for mutual welfare. From the Dagoes who attend to the street lights of our cities; from the Irish hod-carriers up to the most skilled artisans in the country, we find organizations that weld the members so that they can act as a unit and when one speaks it is the voice of authority for all. Among farmers, fruit growers are undoubtedly in the lead in this respect, but still there is relatively a small number of such organizations in comparison with their field of usefulness.

Some of the advantages of co-operation among fruit growers may be enumerated as follows:

(1) All supplies, such as packages, tillage implements and other tools, spraying material, spray pumps, fertilizers, and all other kinds of materials or equipment can be bought by the association in large quantities at wholesale rates and sold to the members practically at cost.

(2) The fruit being grown, picked, packed and handled in every way under the direction of the board of managers it is practically uniform in quality.

This makes it possible to standardize grades and to adopt brands that have a definite significance in the markets and an actual cash value in selling the fruit. It makes possible the building up of a reputation for a whole fruit section instead of for individual orchards as is generally the case otherwise.

(3). It is possible through the association manager to keep in the closest touch with market conditions and hence take full advantage of those conditions. The manager is usually the selling agent; hence the grower is relieved of the anxiety of dealing with fruit buyers when his whole attention is needed in the preparation of his fruit for market.

(4). Under these conditions quantity is not a factor in any individual orchard, as is often the case when a single grower must be able himself to ship in car lots. Quality becomes the aim. This makes possible small orchard or orchards of such size that the most intensive methods can be followed in the management of them. These are some of the more prominent functions of co-operative associations named without regard to their relative importance.

A very large proportion of the thirty thousand cars, more or less, of citrus fruits that are grown annually in California are handled by co-operative associations. Most of the fruit from Colorado, Oregon, Washington and other states of the Northwest is likewise so handled. You know something about the relative prices of this fruit in eastern markets in comparison with the prices that prevail for most of the eastern grown fruit. You have the advantage of the western growers in that they are so much further removed than you are from the large markets of the country. I doubt very much if the western fruit would reach the eastern market, at least not in large quantities, if it was not for the co-operation of the growers among themselves, working through their associations.

With the already important and the increasing fruit interests here in Adams county, I believe there is a grand opportunity for some very effective co-operation along the lines just mentioned. If such is the case, and you make the most of the situation, together with your possibilities for the production of high grade fruit, why cannot the reputation of the Grand Valley of Colorado, the Hood River section of Oregon, the Yakima Valley section of Washington, or of any other section be, in five years time and less, your reputation?

SELECTING VARIETIES, PREPARING THE LAND, AND PLANTING A COMMERCIAL APPLE ORCHARD

By J. ANDREW COHILL, *Manager Tonoloway Orchard Co., Hancock, Maryland.*

Your corresponding secretary has requested me to talk upon "Selecting Varieties, Preparing the Land, and Planting a Commercial Apple Orchard," and as representative of the Tonoloway Orchards of Hancock, Md., it affords me the greatest of pleasure to meet and talk to so many enthusiastic fruit growers, and to find many among you who have selected the same vocation as myself, namely; the culture of the "Fruit of Eden," the apple.

Apple culture is no longer a branch of agriculture where it so long languished; it has become the most important branch of scientific horticulture. As a result of the farmer's poor and neglectful methods, it is predicted that a few more years will see the total extinction of the small farm orchards as a business factor, and the survival only of commercial orchards, conducted according to modern horticultural methods. By this statement I mean only that the fruit grower, be he large or small, must use business and scientific methods in order to survive.

It is a well-established fact that the greatest success of commercial apple-growing depends upon proper selection and the planting of a few varieties only, taking into consideration not merely the present, but the future as well. This is the day of commercial orchards, and the first important stop after you have selected your land is to select your varieties. The selection of varieties has called forth the most painstaking consideration of every feature of growing and marketing by the best professional judgment of well qualified authorities and a close observation of actual results. The Agricultural Experiment Stations and horticultural authorities of the various states, as well as the Pomological Division of the U. S. Department of Agriculture at Washington have for many years engaged upon the highly important work of recording results obtained by different varieties of apples, in the various apple-growing sections, to determine the varieties best adapted to each locality. We made several mistakes in planting our orchards and I consider the selection of varieties the most serious one we made. Do not plant every variety of apples that your nursery may have in stock, or that every Tom, Dick and Harry recommends, for you will never have a commercial orchard if you do, but study and learn

the variety best suited for your soil, climate and markets. I would be just as careful in selecting a good nursery before buying young stock. Decide upon what varieties you want, and then write your nearest reliable nursery, asking if they can furnish the varieties desired, and at what price. State the number of trees of each variety wanted, the age, and specify definitely that, under no conditions, will diseased or insect-infected trees be accepted, nor will substitutions of varieties be countenanced. Save the bill of sale for future reference, for the "Court of Appeals" in New York State has decided that nurserymen may be sued for damages resulting from the substitution of varieties. Go to the nursery yourself and inspect the trees, and insist on getting the varieties you have selected. I prefer a well-grown, one-year-old budded tree. A one-year-old budded tree may be headed low, and the first branches may be used for the foundation branches, selecting those best placed. Furthermore, a one-year-old tree is cheaper than two-year-old.

The Tonoloway Orchard Co., of Hancock, Md., of which I am "field manager" of 350 acres, have 700 acres in apples or over 50,000 apple trees.

The folowing are the varieties planted:

1.	Yellow Transparent,	3,000
2.	Duchess of Oldenburg,	3,500
3.	Wm. Early Red,	1,000
4.	Red Astrachan,	600
5.	Summer Rambo,	1,000
6.	McIntosh,	300
7.	Wealthy,	4,000
8.	Jonathan,	6,000
9.	Yellow Belleflower,	1,000
10.	Grimes Golden,	7,000
11.	Winesap,	2,000
12.	Stayman,	1,000
13.	Baldwin,	4,000
14.	Ben Davis,	3,000
15.	Rome Beauty,	1,000
16.	York Imperial,	12,000

These varieties number sixteen, and even taking into consideration the thousands of trees, and the large expanse of our orchards we feel that by cutting the varieties down to eight or ten, adding the number of trees on to them, the crop would be easier handled and the company would receive better returns on the whole. All sixteen of these varieties are of the best for a commercial orchard, and so I shall make my selection from these which would be in the order of ripening:

Yellow Transparent Wm. Early Red	Early Summer
Summer Rambo	Late Summer.
Wealthy Grimes Golden Jonathan	Fall
Stayman Winesap Rome Beauty York Imperial	Winter

I think that all of these varieties are adapted to your soils. The Stayman Winesap that you grow over here are particularly fine. I have never seen any better Staymans anywhere. They are highly colored, fine in size, and the quality is excellent.

SOME COMMENTS ABOUT IMPORTANT APPLE VARIETIES

By H. P. GOULD, *U. S. Department of Agriculture.*

In the many lines of progress that have occurred in the rapid development of the fruit industry in recent years, there have been none greater than the changed conceptions regarding the *variety* in its relation to successful fruit culture.

Though for many years following the formation of the American Pomological Society about the middle of the last century its most conspicuous work was along the line of variety adaptation, its influence was apparently somewhat restricted—much more so than in more recent years—and apparently not largely felt by the mass of those who were planting fruit trees.

In the early days, the fact that a variety was pleasing when grown in a particular place was taken as prima facie evidence in great numbers of instances that it would be equally as desirable a hundred or a thousand miles distant where the environment was entirely different. Not so at the present time. There is nothing more conspicuous to the discerning fruit grower and nothing more interesting that the great variability of varieties in their response to the influence of environment, for we have come to think of a variety, not as an entity in itself but of a plastic thing which is the product of the influences under which it is grown.

It is worth while in this connection to ask: "What are the influences which affect the behavior of a variety, making it valuable in one place and perhaps worthless in some other?" In other words, what constitutes the environment which determines whether a variety inherently meritorious, is good or bad in a particular place? In the last analysis, the two great determinants or limiting factors for all plant life, and to a considerable extent also of animal life, are temperature and moisture. In the case of cultivated plants we must also add the soil factor and methods of culture. It may be doctrinal heresy to admit it but personally, I put less stress within certain rather broad limits upon the soil factor than upon any of the others that are really dominant in any particular. And for the tree fruits I place greater importance upon the character of the subsoil than upon the surface soil.

To give satisfactory results with any variety of fruit, a soil must have certain characteristics. It must contain sufficient plant food in an available form to induce a good vigorous growth of wood. In other words, it must be sufficiently fertile for the end in view. To this end it must contain humus or decaying vegetable matter in considerable quantites. A soil deficient in humus, more or less broadly speaking, is an unproductive or non-fertile soil. It must be a soil that is sufficiently porous and light to permit water to

percolate through it readily. Such a soil as this will also be easily penetrated by the roots. These last two tenets apply particularly to the subsoil.

I place so much importance upon the subsoil because it is that very largely in which the roots are imbedded. It is the subsoil very largely that acts as a reservoir for the moisture supply required by the trees. If it is too compact, and hard, the moisture does not pass through it with sufficient freedom, either up or down, and the roots find too much obstruction to readily penetrate it for food and moisture. Given these characteristics and a soil so far as the soil factor itself is concerned may be looked upon as having the requisites for fruit growing.

And now that I am referring to this soil factor, I want to mention one other feature. It may be that each fruit variety requires for maximum results its own particular type of soil but I question if we can recognize this from any practical standpoint, on the basis of the soil itself, to the extent that is sometimes assumed. The soil performs three functions in relation to a tree growing in it: (a) It serves as a means of holding the tree upright and in place; (b) it is the source of mineral plant food either contained in it naturally or applied by the act of man; (c) it serves as the direct source from which the tree gets its supply of moisture. A soil may be too light in one extreme or too heavy in the opposite extreme, as we ordinarily use these terms, to come within the broad limits implied in the outset.

There is a most intimate relationship between the moisture supply and the mineral food supply because the latter is available for the use of the tree only as it goes into solution in the water or moisture that is in the soil.

Again, as soils of different types and in different conditions may have different temperatures, there may be a temperature factor involved in the relation of a particular soil to the behavior of a variety.

Now suppose we think we have found for a particular variety the exact type of soil both with regard to its physical condition, its relation to the supply of plant food, moisture and temperature for maximum results in every respect. Very well! But the very next season after we have reached our conclusions it may be abnormally rainy, or abnormally dry or excessively hot or cold as the case may be. We at once have every factor in our scheme thrown out of adjustment and the relationships of food supply, moisture and temperature are entirely disturbed. As a result we find our chosen variety giving maximum results perhaps on an entirely different type of soil from the one we have previously had under consideration, even though that type remains unchanged as a type.

Then, too, we have a variety growing on a particular type of soil and giving certain results under some definite system of soil culture and orchard management. We change our system of management and totally different results follow. Yet the soil, as a type remains the same. The thing I want to impress upon you is simply this: Granting for the sake of the argument the possibility of there being varietal preferences as to soil types within the broad limitations already specified, the soil influences so far as

they affect the behavior of a variety are constantly at work conjointly with all the other influences which go to make up the environment—and a variety is largely the product of its environment. It therefore follows that when we consider the matter of varietal adaptability we must consider it in the light of all the influences that affect its behavior in any way. A variety may be of value or it may not be, depending upon the conditions under which it is grown, and the better we understand those conditions, the more nearly can we make them what we want them to be.

There are various other phases of this matter I should like to discuss but I am already too far from the point of my subject. Time forbids that I wander farther away, except to say that we are in the habit of looking upon many things as pertaining to the soil in its relation to fruit growing that are not soil factors at all. A soil that is too moist may need draining but that is a matter of drainage, not of soils, *per se;* or too much moisture may be the result of too much rain and that is a matter of climate, not of soils; a lack of moisture, or of plant food or of humus to modify the physical condition—these have to do with soil management, not with soil types and soil characteristics. But we sometimes charge them all up to the soil! Methods of culture and of orchard management are fundamental in their influence upon the adaptability and relative value of a variety. Herein lies the phenomenal success of one fruit grower and the flat failure of another when perhaps the natural advantages outside the nature of the men involved are the same in both cases. Herein the grower displays his discrimination as to the peculiar needs and requirements of each variety and his ability to meet those requirements—for not all varieties can be treated the same way with equal success in every case. And it is in the management of an orchard that soil conditions are properly maintained and ameliorated as the case may require.

To return briefly to the temperature and moisture factors. This brings us back to a consideration of the climate in its effect upon varieties—for temperature and moisture are two conspicuous elements of climate in relation to plant life. With a low temperature, and as a result moisture largely in the form of ice and snow, the typical vegetation is moss, stunted evergreens and other growth which characterize the Arctic regions. Given a higher temperature and much of the moisture in the form of rain and we have the mixed, varied and abundant vegetation common to the greater part of the United States. A high temperature and the absence of rain and the Sahara and the Great American deserts appear. A maximum in both temperature and rainfall and the luxuriant vegetation of the tropics is a result. Thus you will see the part played by these two limiting factors—temperature and moisture. To say that each variety of apple or peach or strawberry requires for maximum results its own particular degree of temperature and its own definite supply of moisture at particular periods or epochs in its seasonal life—different from every other variety—may be going farther than we have any right to go at this time, yet from an extreme point of view I think this is theoretically true. Practically, the discriminations may be too minute to be of any real importance in most cases. Yet we know that some varieties will successfully with-

stand adverse climatic conditions which will utterly destroy others; so after all, there may be more in my proposition than we can now fully comprehend.

But climate in its effect upon plant life—and upon fruit varieties—is a complex matter. There is more to climate than temperature and moisture even though we sometimes overlook the fact that this is so.

In naming the different elements of climate we would need to mention:

1. Precipitation (rain and snow).
2. Temperature.
3. Extremes of heat and cold.
4. Times and frequency of frost.
5. Amount and intensity of sunshine.
6. Humidity and transparency of the atmosphere.
7. Direction and velocity of wind.
8. And perhaps the electrification of the atmosphere.

We can readily understand that some of these at least in addition to temperature and moisture have a very close relationship to the behavior and value of different varieties.

Another very important matter in the adaptability of varieties is the location and site selected for the orchard. There are countless orchards throughout the country that are practically worthless because of their location. But when we stop to consider the significance of the location we find that it is mostly *local climate.* It has to do with frosts, and air drainage which are temperature factors; with soil drainage which is a moisture factor; and with winds, etc. So here again we come back to the climate. We must consider the climate in its several elements at every turn.

But I have not forgotten that my subject calls for some comments about apple varieties. Perhaps, though, I need make no apologies for the background I have endeavored to set up. Perhaps any remarks about the adaptability of varieties that may follow will have greater significance than would otherwise be the case because of the "setting" which I have tried to place for them.

Even now before I reach the part of this discussion which gives my paper its title, I want to ask your forbearance a little further. I have recently been very much interested myself in making a sort of inventory of the apple varieties that have entered into American pomology. A portion of this inventory may not be without some interest to you because of its connection with your state.

About six years ago there was published a bulletin by the United States Department of Agriculture, in the Bureau of Plant Industry series, entitled: "Nomenclature of the Apple: A catalog of the known varieties referred to in American Publications from 1804 to 1904." You will at once see the comprehensive character of this bulletin. The year 1804 was taken as the starting point because that is the year in which the first list of apple varieties grown in America was published. It therefore marks the beginning of American catalogs of varieties. The work of compiling the data for the bulletin mentioned was completed in 1904, thus making the period covered by it an even hundred years. The American publications

reviewed for the data, included the standard pomological books, horticultural society reports, experiment station bulletins and reports, horticultural papers and magazines, etc.

The catalog contains all known names of varieties that had been published up to and including the year 1904 and approximates 14,800 in number. This includes all synonyms as well as accredited varietal names. Of the latter there are about 6,700 in number. This means of course that there has been that number of different varieties referred to by name in American publications in the hundred years that is covered by this catalog. A bit of arithmetic shows 8,100 synonyms, thus giving as an average more than two names apiece for every variety, but as several varieties have over forty different synonyms to their credit and others only a slightly smaller number, the distribution of names is not on a very equitable basis.

These totals do not include the crabs. If they are added to this inventory the number of accredited names is increased by about 375, making in all 7,075. Two hundred and seventy-five names are added to the synonyms making 8,375, thus bringing up the total number of published names, including synonyms, to about 15,400.

Of the approximately 6,700 (not including the crabs) accredited varietal names, the origin of about 3,900 varieties is known with more or less certainty and designated in the bulletin mentioned by state for the native varieties and by the country for the introduction of foreign sorts. Of these 3,900 varieties, the origin of which is designated 309, if my account is correct, are accredited to Pennsylvania though in case of 42 of these—a rather large percentage to be sure—there is some question as to their being of Pennsylvania origin.

Of course a large proportion of the 6,700 varieties in the catalog, are now unknown in cultivation. This is made evident by the last revision of the American Pomological Society's "recommended lists" of varieties for cultivation in the various sections of the United States and Canada. This revision was published in June, 1909, as Bulletin 151 in the Bureau of Plant Industry series. The list of recommended varieties of apples contains 319 names of varieties which have been recommended by some fruit grower, professional pomologists, or others capable of giving advice in the matter for planting in some section of the country. The inference is then that a little more than 300 varieties include all, or at least nearly all, (not counting local sorts many of which are valuable), of the really important sorts that are being grown at the present time. In fact it would be surprising if this number could not be greatly reduced without loss to the apple industry. Pennsylvania is credited with seventeen of these 319 sorts as place of origin with three additional ones that are doubtful in this respect. Forty-nine of the 319 are of foreign origin including twenty-four Russian sorts and several which originated in Canada.

With so long a list of varieties from which to choose, there is some difficulty in deciding just what ones should be named in the present connection. As a foundation for a list it is of interest to refer to the revised catalog of recommended varieties of the American Pomological Society above mentioned. For the district that includes this region, the following varieties are the ones highly recommended: Benoni, Early Harvest, Gravenstein, Grimes, Maiden Blush, Margaret,

Red Astrachan, Rome Beauty, Smokehouse, Stayman Winesap, Wealthy, Winesap, Yellow Transparent, and York Imperial—fourteen varieties. But Adams county is very near the border line between two of the districts defined by the American Pomological Society. As the boundary limits of these districts are more or less arbitrary it may be of interest to note the highly recommended varieties in the adjoining district. In addition to the above named sorts, they are as follows: Arkansas (Mammoth Black Twig), Ben Davis, Bough (Sweet Bough), Buncombe, Chenango, Gano, Golden Sweet, Horse, Ingram, Jefferis, Jonathan, Limbertwig, Missouri, Oldenburg (Duchess of Oldenburg), Ralls, Rambo, Red June, Red Stripe, White Pippin. This increases the list by nineteen varieties—a total of thirty-three varieties combining the two lists.

Of the well tested commercial varieties this combined list contains some of the most valuable sorts suitable for planting in the middle latitudes—material for some very choice selections.

And added comment about the more important of these varieties will serve to indicate their predominant characteristics. Benoni is a beautiful little apple of high quality ripening in this section the latter part of August; too small for Commercial purposes but excellent for home use. Early Harvest, Red Astrachan, Maiden Blush and Gravenstein are standard early sorts probably too well known to require comment. Red Astrachan has a lot of faults but as an early variety, red in color, I know of nothing to take its place. For a first early variety Yellow Transparent has attained front rank pretty nearly all over the country. The tree sometimes blights but it is very valuable for all of that. Smokehouse and Wealthy are early fall—probably September varieties here—of much intrinsic merit and for their season it is doubtful if there are any better for this section. Grime and Jonathan are used as "running mates" in many sections and are of first importance. There are few varieties grown commercially that are so high in dessert quality as these. Excellent sorts they are, one which to make a reputation that will be a distinct market asset. Grimes scalds in storage too badly to be very satisfactory for that purpose, but as a fall sort it has few equals.

Jonathan, normally of about the same season as Grimes is an excellent storage variety and in some sections it is one of the three or four most important commercial varieties. It has a wide range of adaptability and is being extensively planted. While it might be unwise to plant it extensively in Adams county without more preliminary tests, I am impressed with the probability of its value. I think there can be little doubt about the value of Grimes for your conditions when properly handled.

Looking at the exhibits here and talking as I have with your people, makes me more firmly convinced that Rome Beauty and Stayman Winesap are two of the most important varieties that can be grow here, unless they develop some faults here which I know nothing about. Stayman sometimes lacks a little in color especially on young trees but as they obtain a little age, this difficulty largely disappears. Rome Beauty may have some defects peculiar to this section which I do not know about but a short time ago one of the finest specimens of this variety that I have seen in a long time reached our office in Washington from Biglerville, this county.

Winsap, though it is a magnificent variety in New Jersey within a radius of twenty miles of Philadelphia, may approach its northern limit of adaptability in this section on account of the elevation, though I am not sure but that it is entirely satisfactory here.

York Imperial is too well ensconced in the hearts of the fruit growers of this section to call for any comment though it is a little lacking in dessert quality.

I have now referred to all of the sorts mentioned in the first list of recommended varieties, also Jonathan of the second list because of its value in connection with Grimes. The varieties recommended for the adjoining district cover conditions that are very diverse from those in the district in which Adams county occurs. Therefore a considerable proportion of them are not to be considered in the present connection. Several of them, however, may well be referred to briefly for the purpose of pointing out their faults as well as to indicate their merits.

Arkansas, more widely known under its synonym, Mammoth Black Twig, is an excellent apple of the Winesap type and has a magnificent tree but it is generally such a shy bearer that it is unwise to include it in a commercial orchard, except in a very few localities.

Ben Davis I had intended to pass over in silence, but a few days ago I noticed in a report of the proceedings of the American Pomological Society, published nearly fifty years ago when John A. Warder, one of the most conspicuous pomological geniuses this country has yet seen, recommended it to that Society with the remark that he did not wish to say much about it but that he believed "It is a variety that will yet make a noise in the world." How true this prophesy has been made into history!

Sweet Bough is widely grown in this general region of the country for an early sweet sort. Jefferis for late summer or early fall has decided merit. It is of Pennsylvania origin and doubtless deserves a greater popularity than it now has. Oldenburg (Duchess of Oldenburg) for a second early apple would probably be successful, though its quality is not high, and its value is entirely for culinary purposes.

Ingram, which originated in Missouri, a probable seedling of Ralls, is valuable in some sections because of its lateness in ripening and its long keeping qualities. It is a late blossoming sort and because of this fact is sometimes bears a crop of fruit when other varieties are destroyed by late spring frosts. I am not aware, however, that it has been tested in this section. It ought to be tried here for a long keeping sort. Rambo is a Pennsylvania standby which has much to commend it for its season though apparently it was relatively more popular formerly than it is now. White Pippin has a wide range of adaptability as we find it doing finely in Maine, in Maryland, Missouri and Kansas to say the least, and I do not know how much more widely it is scattered but under the diversified conditions in the regions indicated, it seems practically certain that it would do well here. It has been mistaken sometimes for Yellow Newton or Albermarle Pippin, though its differences are well marked to the critical eye. I have not seen it from Pennsylvania but think it is worthy of consideration for this section.

The other varieties recommended in the second list are not sorts that I should care to commend to you for this section so will not take the time to refer further to them.

In addition to these varieties there are several others that are important sorts elsewhere but do not appear to have attracted attention in any part of this State. I refer to Early Ripe which is an early variety of increasing importance in the early apple industry of Delaware and New Jersey, that ripens nearly with Yellow Transparent. In Delaware they sometimes pick before it is matured. It is a remarkable apple. It holds to the tree well after it is matured and may be picked when quite green.

Williams likewise is a very valuable early sort in the states just mentioned. It has sometimes been confused, however, in at least one nursery in this State with Sops-of-Wine, a very different apple, the latter being sold as Williams Favorite which is also a synonym of Williams. Cornell (Cornell Fancy) is another second early sort, commonly credited to Pennsylvania—the southeastern part of the state—for its place of origin. It is a very desirable variety of high quality and I believe might with profit be given a much more prominent place in this section than it is accorded.

Thaler should perhaps also be mentioned in this connection. This is a Russian variety and nearly or quite indistinguishable from Yellow Transparent in fruit but the tree is said to be more vigorous than Yellow Transparent. It is very rarely grown, at least not under that name. It may be confused with Yellow Transparent in some cases.

In some parts of your state, Wagener is popular though inclined to overbear. For a winter apple, however, it may have merit for your conditions. It is of good quality; frequently recommended to be used as a filler because of its early bearing and rather small size of the tree.

Another variety, one which has been attracting considerable attention in Virginia for the past few years is Lowry. It originated in Nelson county, Virginia, a good many years ago, but it is only recently that it has become prominent. It is a beautiful red or indistinctly striped apple of good size—a good keeper and prolific. But like all the rest of its kind it has a weak spot. It is not quite good enough in dessert quality, still it is fair in this respect. I do not know of its having been grown north of Virginia but mention it to call your attention to its possible value here.

Now if a grower was selecting varieties to plant for a succession of ripening from early to late from the varieties already mentioned, he would not want all of them unless he was undertaking to plant a variety test orchard. Individually of choice would have a considerable range. My particular selection would be no better than that which any one else might make but if I were planting a commercial orchard in this section to include a full sequence of ripening, I think my choice, in the light of my present knowledge would be about as follows: Yellow Transparent (or Thaler), Early Ripe, Red Astrachan, Williams, Cornell, Maiden Blush, Gravenstein, Wealthy, Smokehouse, Grimes, Jonathan, Stayman Winesap, Rome Beauty and perhaps York Imperial. If I could find something to substitute for Red Astrachan I would do it but I know of no red

variety at present that will take its place. And if I could handle to advanatge more mid-season sorts I should want to add Jefferis and Summer Rambo because of their merit.

Sutton Beauty would be a consideration to add to the winter season. I do not know of this variety anywhere in this state but in New York it has been planted more or less in recent years and it is apparently growing in popularity in that state. It of course does not follow that it would be of value in this section but its possibilities are worth consideration.

Lankford, a Delaware seedling that originated nearly 70 years ago has become quite widely disseminated though it is not extensively grown. It may have some possibilities as a winter variety for this section.

With these other winter varieties I have mentioned, if I could find evidence that they were well adapted to my location, I should be inclined to drop York Imperial from my list as it isn't quite good enough in quality to conform to my standards and add one or more of these other sorts. I know that is a good deal like throwing a bomb and I may be slandering your most profitable variety. The fact still remains, however, that it does not rank very high in quality.

We might go on in this way almost indefinitely but time forbids anything further than to enumerate some of the varieties that are now attracting attention which have unknown possibilities for this section but which are worth testing. Perhaps in such an enumeration Delicious should head the list because of its widely advertised qualities and its recognized merit under suitable conditions. King David is its counterpart. Oliver Red under the name *Senator* has also been considerably advertised and planted but the tree is too susceptible to disease to recommend it. Likewise Collins Red has been disseminated widely under the name *Champion* and while this is productive and beautiful in appearance, it is too poor in quality to commend it to discriminating planters. The last three sorts mentioned are chance seedlings from northwest Arkansas.

Adding still others to this category, there is Akin from Illinois, Bloomfield from Maryland, Doctor included in the first list of "apples most commonly cultivated" that was published in this country, though still unknown to most fruit growers, Virginia, Beauty from southwestern Virginia; Carson from northern Ohio; the Magnate which originated apparently from the same collection of Winesap seeds that produced Stayman Winesap from eastern Kansas; Ensee from southern Ohio; Florence, an apple somewhat similar to Jonathan having a fine vigorous tree but less desirable in dessert quality than Jonathan from northwest Arkansas; Mother perhaps now a century old, coming originally from Massachusetts, but still largely unknown; Coffman an early sort of much promise from Tennessee; Celestia, another sort from Ohio; Ramsdell (Ramsdell Sweet) referred doubtfully to Connecticut for its origin; Adams, a long keeping variety of the Rambo type and of good quality from Blair county, Pa. All these, and almost an endless number besides are worthy of some very definite consideration by those of you who are seeking a reputation for the production of apples of strictly high grade as to quality and beauty of appearance.

And still we need others. Of this collection, not one is perfect; not one that does not have some fault or objectionable feature of some kind either in fruit or tree.

Following up the history of nearly all of our most valuable and best known varieties, we find where we can trace them to their origin that they came into being in most cases as chance seedlings, without the aid or intervention in any way of man.

In this connection it may not be inconsistent for me to repeat what Marshall P. Wilder as President of the American Pomological Society said repeatedly 50 years and more ago: "It was my first, so shall it be my continual and last advice: 'Plant the most mature and perfect seed of the most hardy, vigorous and valuable varieties; and as a shorter process, insuring more certain and happy results, cross, or hybridize your best fruits.'" This advice I wish was being more commonly followed today. If "chance" has accomplished so much in the past in producing apple varieties, what are the possibilities in the production of varieties in the future, should all the knowledge of the present time regarding plant breeding and heredity be directed to this end?

GENERAL ORCHARD MANAGEMENT

By SAMUEL FRAZER, *Orchardist, Geneseo, N. Y.*

In discussing this question of General Orchard Management it may be wise to first relate the story of the beginning of our young orchards. These were planted nearly four years ago. At that time I had the idea that the best thing for me to do would be to top work most of the trees to the varieties I intended to grow. I did not top work everything, but planted some varieties as they came direct from the nursery in order to have them as checks. I may say at the outset that I am not in favor of the top-working and have been forced to this conclusion by my own results. It may be that as time goes on I shall see reason to change my mind. Thus far I am not prepared to advise it.

We have something like 150 acres of apples, the permanent varieties being Baldwin, Greening and Northern Spy. There are but 10 acres of bearing trees on the farm; among these we found 3 Greening, 3 Baldwin and 3 Spy trees which appeared to be better than the others, and almost all of the wood we needed for top-working was taken from these trees. In order to have a complete check on the method I top-worked six rows of Greening with scions taken from an ordinary nursery. I may say here that these do not show the same type of foliage that we find on our own trees. We can detect individual differences in trees, and we know that in some cases these are transmitted.

We began by planting our trees in the spring with the idea of budding them in the fall. A few which were planted the fall pre-

vious were grafted in the spring in the limbs, and we secured about 80 per cent. stand of the grafts put in. At the time of budding we had a small epidemic of fire blight. The nurseryman had contracted to change the tops of the trees as I desired, therefore, he had to do the budding and grafting; and although, I told his man I did not want him to try to bud any trees which showed fire blight, he would persist in taking the chance of putting a bud in and going several inches below the seat of infection. In most of such instances he managed to get the knife covered with the bacteria from the diseased tree and he would inoculate the succeeding ten trees; and, since we were putting in four buds, one on each side of the tree we had four seats of infection. The weather was favorable for its rapid growth and there was nothing left but to condemn the trees. Out of some 8,000 trees 2,800 showed fire blight that fall. In my judgment it was better to remove them and burn them than to try and clean it up; so we took them all out the next spring; and I requested the nurseryman to send me trees to replace them, which he did.

In this case, however, we adopted another policy: We were able to plant the trees the last of March, and in April beginning even before there were signs of growth, we sawed the tops off at the height of 18 inches from the ground and put in a graft. I may mention that these trees were ⅝-inch two-year-old buds. Generally speaking, we had a very good stand and these grafts would make a growth of from 2½ feet to 4 feet that season; and, if it was necessary to do any more top-working, I would prefer to do this in preference to any other. Personally, I would rather grow the trees from individuals and take the time, rather than try to top work. I think I can get a better head and save much trouble afterwards; for it is necessary to go over all these trees carefully, even today, to make sure that shoots are not coming out of the stock, and all of this difficulty is avoided when the trunk is the same as the top.

PLANTING

In planting we usually prune the roots as little as possible, merely remove any injured roots. Prune the tops after it is set. We dig as small a hole as we can and put the roots in, and insist on the soil being well packed round them; this is the most important thing in planting. Take a tamper along and make sure that no roots are left out of contact with soil. If the tree has four limbs we do not touch it. I would not on any account cut back the ends of the branches. If it has five or six limbs I would take one or two off, leaving three or four. If it is possible, we like to space these limbs six inches apart, so that if the lowest begins at 18 inches from the ground the highest would be nearly 3 feet. In the case of varieties which tend to droop as R. I. Greening, I have left a few trees with a leader for experimental purposes, but in the bulk of the cases we have merely the four limbs.

I understand from others that it is going to be more difficult to handle these trees successfully than it would be if the leader were left. We shall know more about this matter later.

The land we took was not in the best of condition. Most of it needed underdrainage in order to give good crops and permit of proper cultivation. The land is a little too heavy for potatoes and the results we secured from trying to grow corn between the trees were not encouraging. It seemed to shade them too much; so that we are growing the trees without any crops on the land between them. We plow the land or disk it as soon as possible in the spring and keep it cultivated until July or the first of August, at which time we sow a cover crop. During the past year on 200 acres of orchard we sowed a mixture of 1 pound Cow Horn Turnips, 4 pounds Dwarf Essex Rape, 5 pounds Crimson Clover and 5 pounds of Red Clover per acre, and in addition, we allowed all the rag weeds, pig weeds and other weeds that would grow to come up. Some of them have made a wonderful growth the past year, growing tall enough to hide a horse. We manure the apple trees each year, with a light dressing of farm manure. The first two years we gave them a small application of probably 1 to 2 pounds per tree of a mixed fertilizer about 3.8.8. This past year we have used Basic Slag on some of the apples at the rate of 800 pounds per acre on bearing trees, and have had very marked results. Certain trees were left as checks, and on them the foliage was not nearly so large, nor was the growth made this season so long. In the past we have had more results from Acid Phosphate when applied to the peaches than from any other fertilizer, but during the past year we did not get any results with either Floats at the rate of 1,200 pounds per acre, with 500 pounds of Iron Sulphate or from Basic Slag at the rate of 600 pounds per acre, or Acid Phosphate at the rate of 600 pounds per acre. The trees did not show any improvement over those which had nothing. We shall continue this experiment for certainly two or three more years, since these trees are located on one of our best soil types.

PRUNING OF PEACH TREES

When we plant the peach trees we cut them off to a stub about 12 to 15 inches long. On this we allow 3 limbs to grow, removing any others. Since that time these trees have not been pruned. They were 3 years planted last May and last year they bore a sufficient number of peaches so that the sales were $50 per acre on one block of nine acres. Our trees do not make the growth that yours do in this vicinity; they have not the size that yours would have, but they are much larger trees than those grown in orchards where heading back is practiced each year; and by allowing them to bear early they will get the necessary spread of limb and open center which we aim for. The trees are full of fruit buds and it hardly seems necessary to do any pruning this year, except in the case of a variety like Late Crawford, which makes a great deal of wood. We shall be able to pick everything from the ground next year as we did this. As they begin to grow higher we shall head them back.

On Herbert Wadsworth's Estate at Avon, trees handled about the same way yielded as high as 10 and 11 baskets, that is one-third bushel baskets per tree; in other words, a yield of 3 to nearly

4 bushels of fruit. These trees had been manured during the first two years of their life. The soil is sandy and they have been kept cultivated all the time, absolutely clean tillage. The trees have not been pruned at all. Alongside is a small apple orchard, trees were planted four years ago. Some of the Hubbardston trees had from 75 to 126 apples each, which made a good crop for so young a tree; in fact, it was necessary to thin them two or three times to prevent their over-bearing. While the limbs and tops of these trees may have appeared close, this weight of fruit is giving them the necessary spread, and limbs which would appear too close are now pulled down, so that they do not need to be removed. The permanent trees in this orchard are Baldwin and are the same age. Almost every tree had from 30 to 40 apples on. The results thus far secured by leaving the trees alone are such that we are encouraged to do less and less pruning.

The way of pruning is very important. Leave 4 limbs six inches apart on the trunk if you can. We find we can do it. Do not cut the terminal buds off these limbs. Remember they are the ones which will come into growth first and if removed the tree will probably be all of ten days longer in getting the latent buds into leaf, and that ten days cannot be recovered. We must get leaf growth—in order to get root growth. The sooner the tree gets into business after it is planted the better. In some cases when we cannot get the branch where we want it we have put a bud in the trunk. We have tried yearling buds and some two-year-olds and like the yearlings very well. At the end of four years they seem to be just as far ahead as the two-year-olds. They are very easy to plant. One block of 1,000 were put in this year at the cost of about 1½ cents each for planting.

PRUNING OLD TREES

In the case of trees at the bearing age which have been neglected and allowed to become quite thick, we found it advisable to prune such only during the bearing year. Pruning them late in the season after the blossoms have fallen. In this way we have avoided any tendency of water sprouts. We find we can take much more wood out with safety than if we prune in a year that the tree is not bearing, and in the case of all varieties which bear every other year normally, such as Baldwin, I would rather wait one year and prune heavily when they are bearing. There is one rule we give in regard to the amount of wood which shall come out of a tree. It is this: 1. Remove all dead wood and badly diseased limbs. 2. Remember that the sun must reach all parts of the tree sometime in the day If it cannot reach a limb, either that limb or some other must come out. Another rule is this: If it is a question of an upper or lower limb; save the lower.

We have a bearing orchard of about 6½ acres of trees scattered over ten acres. It had been neglected and was about 33 years old. The trees were 33x33 feet apart. They were all touching and were too thick. The orchard was in sod and was rented for pasture for the sum of $25.00 per year and the most the crop had sold for was $75.00, according to the statement of the tenant. I paid the tenant

$75.00 to let me have it; and in May, 1906, I borrowed a spray rig and we sprayed it. We did some pruning, taking out the dead wood. We sold the fruit on the trees that year with 400 barrels which I had ordered for $900.00. We made a map of the orchard showing the varieties. The following year was the off-year, and the land was still in sod, and the crop sold for $630.00. In 1908 the land was plowed and every other tree had been removed during the previous winter. We were able to do this from our map, having carefully noted on it all trees which were of poor varieties or injured and making careful tally to find which row would need to be removed in order to leave the most good trees. We took out every other row on the diagonal, sometimes some good trees had to come out; in other cases we had to put a young tree in, but in spite of the loss of trees the yield that year sold for $1,320.00. The trees were pruned again, taking those which were in bearing. The following year we sold for $1,340.00 and this year, 1910, which should have been our big year we had very poor weather at the time the Greenings were in bloom and had a very small crop of this variety, which constitutes a large proprotion of the orchard; so that our yield this year will not sell for much more than $1,200.00

SPRAYING

Our method of spraying during the past year was to spray about the time the buds were breaking until the leaves are the size of a mouse's ear, with Lime-sulfur 1 to 9 with 2 pounds of Arsenate of Lead to 50 gallons. This takes care of the Blister mite which is moving at that time and the Arsenate of Lead is for the bud moth and case bearers which have been a serious trouble in Western New York. We intended to spray again just before the blossoms opened, but left it until the blossoms fell. The omission of No. 2 spraying was a mistake, I believe. The second year we had the orchard we used Bordeaux mixture and Arsenate of Lead for the spraying after bloom, but we had so much injury from the Bordeaux that we have not used it since, using merely Aresnate of Lead. This gave us good results. We sprayed the trees from 3 directions with Arsenate of Lead at the strength of 2 pounds to 50 gallons, and on trees which would bear 10 to 14 barrels we find we have applied about 17 gallons of solution to a tree in the three sprayings. This was followed in ten days with a light spraying of weak Bordeaux with Arsenate of Lead. This past year, however, we changed our policy and used Lime-sulphur at the strength of 1 to 33 with 2 pounds of Arsenate of Lead as soon as the blossoms fell and did not apply so much to the tree, but even with this we found we encountered russeting where the fruit met the full force of the spray. Where the fruit did not get the full force of the spray the Lime-sulphur tended to control the natural russeting of the fruit; and in a neighbor's orchard where the material was put on with a hand pump at a much lower pressure than we put it on, the russeting was almost eliminated; while in a neighbor's orchard which was not sprayed, it was quite prevalent; so that we are convinced that russeting may be due to natural causes as well as spray injury, and may result even when Lime-sulphur is used. Our modified method of this year was not

thorough enough to control all the codling moth. Next year we intend to make our Lime-sulphur much weaker probably 1 to 70 and resort to a thorough drenching of the tree as soon as the blossoms fall in order to conerol the codling moth.

We tried making our own concentrated Lime-Sulphur, but cussed it and quit. We had—the picnic of our lives. Your Prof. Stewart told us all about it at one of our meetings, how nice and easy it was to do. He told us how to cook it. We tried it in the basement of the creamery. It fumigated the creamery all right. Just about the time we had it all nicely cooked, for some reason it would boil over, and half of the contents of the barrel would be on the floor and sailing down the sewer before we could catch it. Someone has to boil it. I am willing to let the other fellow do it.

MANAGEMENT OF 700-ACRE ORCHARD FOR ONE YEAR

By MR. COHILL.

Again it is my pleasure to address this Association, continuing our talk of the preceding day to the culminating phase of orcharding, its management.

This is an exceedingly broad subject and my object in view is to give simply and briefly the essential points of the management of a 700-acre orchard for one year. It would be the work of volumes to enter minutely upon the details of orchard management and my idea is to speak in general upon the essentials. Any points on which my assistance may be of aid to you, I would be only too glad to help you if I can. Don't hesitate to interrupt me at any time.

I want to bring out a point in Mr. Frazer's talk, which covers our conditions, regarding potato culture in an orchard. We allow our men to have patches. Usually they plant potatoes, with the result that the fruit we harvested (the first three crops) was practically worthless, hardly any value at all. Other places, where fertilizer, manure and cover crops were used, we had almost the same result, and it looks to us as if we would either have to grow fruit or potatoes. We plant the trees so close, 20 feet apart, that it is not profitable to raise anything between them.

We pay our laboring men $1.50 per day, 15 cents an hour, and furnish married men with a house costing about $600.00 or $700.00, then charge them rent covering the interest, or $4.00 per month. We, also, give them truck patches, furnish them with wood, horse to drive to town, etc.

PRUNING

It is very important that young trees get proper pruning for much depends upon it in the future. In many orchards improper pruning is practiced, while in others no pruning whatever is done.

I must say that better results can be obtained from the latter. Many orchardists have the idea that after a bunch of men have been started to pruning that all is well, and they will do the work properly.

Well let me tell you that this is taking a long chance, for we have a high class of laboring men working for us, as well as responsible foremen, but nevertheless the field manager is on the job. We do our pruning during January, February and March, keeping a force out when weather conditions will permit, usually about half time is made.

These three months are usually severe but we find some very favorable weather, and with plenty of men, have time to treat each tree individually or in other words, treat each tree as though it were the only one we had. We had our inexperienced man with one of a year or more experience, making two men to each row. until the inexperienced men have been taught, then each man thereafter takes a row and is responsible for it.

Each man is equipped with a saw, large pruning shears and small hand pruners. Following behind the pruners is a boy to cover all wounds over half inch across, with white lead and linseed oil paint to prevent the exposed wood from drying out. We, also, use a boy to gather up the cut limbs and put them into piles. We use a team with light sled, with very broad, light bed, to carry the brush off to a vacant space to be burned. Be sure to haul this brush off before growing season, because there is nothing which looks worse than trash of this sort in an orchard, and it also prevents clean cultivation.

The old style of high-headed apple trees has gone out of favor with the progressive fruit growers, and the common sense method is taking its place. The low-headed trees have the advantage of high-headed ones in being easier and cheaper to spray, prune and gather fruit from, and less injury to dropped fruit, and less injury by storm.

The fruit will color and ripen as well. The disadvantages are none, provided they are pruned properly.

There is a great difference of pruning fruit trees, by growers, college professors, and men with theories, and one point upon which they differ mostly is the "straight leader" and the "open head."

We have experimented with the "straight leader" and the "open head" methods of pruning an apple tree, with the result of adopting the straight leader as the best.

FIRST YEAR

The first year consists of pruning done when the trees are planted but if any new shoots tend to make the tree unsymmetrical the tips should be pinched off in the summer to check their growth. This summer pinching of symmetrical shoots should be done whenever necessary in the following years.

SECOND YEAR

Cut out all surplus branches and prune back the foundation branches from one-third to one-half their growth, making the tree

symmetrical and leaving the central leader shoots longer than the others. Avoid crotches, as they will surely split later and ruin the trees.

THIRD YEAR

Do not let two branches cross or rub, and if twigs have grown on the foundation branches near the trunks do not disturb them, except to cut back several buds to induce fruit spurs.

FOURTH YEAR

Until the trees begin to bear the foundation branches should be cut back annually to make them short and strong to support heavy loads of fruit in the future. After fruiting begins not much pruning is necessary, except to thin out surplus growth and keep the tree symmetrical. In cutting or sawing off all limbs the cut should be *made close* so *as not* to leave a stub. This is very important for wounds properly pruned heal over readily, while stubs seldom heal, thus decaying into the trunk is the result of weakening and injury to the tree.

Another very common mistake is pruning from the bottom up, but this should not be done. Prune from the top down.

FERTILIZATION

We get our fertilization in the form of manure, cover crops, and commercial fertilizer. We have excellent railroad facilities, having a siding of the W. M. R. R. right in our orchard. The most of our fertilizer is gotten in the form of manure, bought in the cities of Hagerstown, Washington and Baltimore, in carload lots, and our teams are kept busy hauling from January to March, or up until spraying season for scale. There were three cars standing on the siding when I left home, and the teams are now busy spreading it about the orchard.

During these months we have quite a little sledding snow, which is the best time for hauling heavy loads, so we get an unusually heavy supply during good sledding. It is best handled in Gondola cars which average about 30 tons.

SCALE SPRAYING

Spraying for San José scale is the next work of importance with us, which we start just as soon as weather conditions permit, and push this work very hard in order to get our teams started on cultivation. If there is such a thing as a commercial orchard of any size being free from scale, I think we have one, for the State Entomologist and State Horticulturist, as well as the state orchard inspectors, go through our orchards every year and make close observations and have reported *free from scale.* We spray annually as a preventive using concentrated lime and sulphur 1 to 8. There is only one way in which to keep your orchard free and that is to spray every year and do it thoroughly.

Just as soon as spraying is completed we start on our cultivation. This year we expect to greatly increase our stock and run a separate crew of cultivators and sprayers, for cultivating really should be started when spraying starts, if the soil is in condition, and to get perfect apples it requires at least three sprayings. Previous to this, one force of teams have done the work, as the amount of fruit has not justified so many sprayings.

HORSES VS. MULES

The first thing of importance in cultivation, and in fact all orchard work where stock is required, is to select the animal to do the work, and we find the good mule our best friend in that respect.

Emphasis on the *good,* for usually when you speak of a *good mule* people laugh. A great many people do not know a mule only as a kicker, balker, and an animal with all sorts of bad faults, but let me tell you we have a lot of *good big mules* that have no tricks and beat the horse at every stage of the game.

We started with big horses and are replacing with big mules, our experience with them prove these advantages.

They eat less feed, they do almost twice the work on hot summer days. A man can kill a horse in summer on a hot day, but the mule can kill the man. They will stand rough treatment by indifferent drivers just like a goat in getting over rough rocks—breaks and new grounds, and are just as good on the road. These qualities are what a fruit grower wants, and a *good big mule* will fill the bill.

SPRAYING FOR THE PROTECTION OF THE APPLE

The codling moth is one of the most serious insect pests the fruit grower must combat. Data collected by the Government and State Experiment Stations have found that from forty to sixty per cent. of the annual yield is injured by the codling moth, which makes the fruit unfit for a market, and some almost worthless for home use. While a large number of up-to-date orchardists do spray for the pest, a vast majority do not appreciate the extent of the injury it causes.

The first spraying for the codling moth should be just as soon as the petals begin falling and before the lobes of the calyx draw together. This period of time is about ten days. Have a good mouthful of poison there when the larvae attempts to enter the apple.

CULTIVATION

On account of the location of the Tonoloway orchards, on such hilly and rolling land, the practice of cultivation will need to be modified because they cannot be handled like an orchard on level ground. In hilly or mountainous orchards clean cultivation cannot be safely adopted, on account of the danger of serious washing away of soil, unless furrows are plowed following the contour of the land, to check this washing.

We plow strips wide enough to cultivate with a harrow on each side of the tree, along the rows, in the spring and cultivate until

July 15th or 1st of August. After thoroughly cultivating these strips, every other middle may be plowed, leaving one solid and one cultivated. The following year plow up the remaining middles and leave the other down in clover crop; these strips prevent washing. There isn't any land too steep to practice clean tillage by this method. After harrowing down, the fertilizer can be applied and a cover crop sown.

COVER CROPS

For cover crops we use crimson clover, red clover and cow peas, using cow peas for a summer cover crop, and crimson clover and red cloved mixed, on alternating year for our winter cover. I have with me a written account of the cost of maintaining (of what we think an ideal 30-acre apple orchard) for the first eight years, with details of cultivation, cover crops, fertilizer, pruning and spraying and would be glad to show it to anyone interested.

A great many complaints are made by growers of their cover crops not taking, and the trouble usually lies in the ground not being properly prepared, and also if the ground is dry the seeding should be delayed until rain comes. Crimson clover especially will not germinate in dry soil. Run the harrow just ahead of the sower, not a week ahead, not two days ahead, but the same day.

GOOD ROADS

I don't know how strong Adams county is for good roads. Good roads are an absolute necessity to the fruit grower, so when it is too wet to cultivate, make a good road through your orchard to the packing house. Get out your neighbors and everybody help repair the county road to your railroad station. You had better look after this because bumping over only a few stones to the station will ruin your fruit for market.

If you have a dirt road, get the county's road plow, a road scoop, and level up with *split* road drag. In the spring or early summer is the best time.

PICKING

It has come to be regarded among good orchardists, as important not to bruise an apple as it is not to break an egg. Careful handling of the fruit is the first essential to good prices. Good packing can be brought about by careful picking. The fruit must be picked at the right time, and handled with great care in getting it to the packing house. Do not pick all the fruit at one picking. This holds true with nearly all varieties for if the small apples are left upon the tree they will often increase in size enough to make a No. 1 fruit. In picking, see that the whole stem is removed and without breaking off the fruit spur, as the future crop may be injured. Keep the fruit out of the rain and hot sun.

We use a picking bag and pour the fruit into a lined box made of special durability, with sawed out hand-holes to lift by. Make the box to fit the wagon bed with a double decker type.

GRADING

We have not adopted the box packs as yet, for the barrel has been exceeding profitable for us, although we expect to put up some boxes next year. The company thinks as long as they get $4.00 to $5.50 per barrel it beats the box. Solid cars of our Jonathan reach the price of $5.50 per barrel shipped direct from the orchard as soon as picked, to New York.

We pack three grades of barrels, fancy, No. 1 and No. 2's. The fancy and No. 1's have a label of the orchard company, while the No. 2's have no identification, but marked plainly a No. 2. The fancy is a large uniform, well colored apple of the variety, while the No. 1 is of a smaller uniform size, well colored, all larger than 2½ inches. The value of accurate grading of fruit to a uniform size and appearance, is the selling factor of any package, be it a barrel or a box.

WORMING TREES

This is one of the utmost importance to a young orchard The best time to worm is in May or September; we worm our trees every year in the early fall. This busy little worm does a great deal of damage, and by the time we get around to him he has done what he thinks his duty in killing the trees.

Washing the young trees with whale-oil soap is the next fall work. This has a tendency to keep rabbits from tearing the tree, and is very effective against San José scale, and also makes the trunk and limbs clean and smooth. Dilute 2 pounds of whale oil soap to 1 gallon of water, boiling the soap until dissolved and apply to the tree, either by spraying or put on with a whitewash brush, over the trunk, fork and main limbs.

I note with interest what Mr. Frazer tells about whale oil soap controlling the worm. We have used whale-oil soap a number of years, both fall and spring, and, though it might have effect on them during egging, I think you will find the worm there just the same.

This completes the year's work, as this brings us within a few days of Christmas, and work is closed until the first of the year. So our only vacation is during the holidays.

POTATO GROWING IN YOUNG ORCHARDS

By SAMUEL FRAZER, *Orchardist, Geneseo, N. Y.*

The question of growing a crop in an orchard is one which we can discuss and probably agree to disagree upon. The prime object in growing potatoes is to make money. I am informed that your value of land is from $50.00 to $70.00 an acre. Your average yield of potatoes is somewhere near 90 bushels. So far as the value of the land is concerned you would be perfectly safe in using it for

potato-growing. In fact, any land which will grow a good crop of potatoes and is under $200.00 an acre in value may be used for that crop, while if the same land should rise in value so that it is worth $300.00 or $400.00 per acre and the yield should not be increased it is doubtful whether potatoes could be grown at a profit. We have then one other factor to consider and that is the question of yield. Is it adequate to cover the cost of production? How much does it cost to produce an acre of potatoes? After you have paid this item and the rent and the interest on the money have you anything left? If you have not there is no use growing potatoes. In this crop you have to compete with many sections which are particularly adapted to potato-growing. For instance, Northern New York, Maine and parts of New England, so far as the main crop is concerned.

In regard to early varieties. You are in competition with other states. It is a question for each one to find out whether potato-growing is profitable for themselves. If potato-growing is not in itself profitable then it certainly should not be put in an orchard with the idea of getting a certain sum back to pay the orchard expenses. It is quite possible that you could charge off $8.00 an acre from the working expenses to trees, but I consider it is really unwise to try and grow the potatoes close to the trees. I would certainly leave 4 feet, the next year 6 feet, and later eight feet on each side of the row of trees. If the orchard be planted to fillers there is so little land left that I doubt whether it will pay. Orchards are worth so much more than potatoes that I would seriously question the advisability of growing some low valued money crop in them. If the money crop grown is highly productive and does not draw too heavily upon the soil I think it would be better. Or, again, it might be better to run the orchards in the extensive fashion, without a crop and concentrate on three or four acres on some other part of the farm and in this way earn sufficient money to carry the orchard. Or, we can look at the matter in another light, and that is, one which I use in almost all other crops, namely, you determine first whether you have or can secure enough money to grow the crop until harvest. If you undertake to grow radishes you may have to wait but six weeks; if you attempt to grow potatoes you may have to wait four or five months; if you plan to grow apples you have to wait six or seven years. I think it would be better to look at the subject from a business standpoint and try to get enough capital and get some way to carry the crop until it is ready to produce some revenue, and devote all the energy of the land to that crop. I hoped at one time that I could do otherwise, but I have been forced to this position by experience. I realize that my experience may be decidedly different from that of yours in this locality, and therefore, hesitate to advise you whether you should or should not grow potatoes in a young orchard. In some sections of New York our growers report adversely on growing potatoes, especially in peach orchards. They have had such poor results that they consider that they have lost two or three years growth of the trees, owing to the influence of the potatoes upon the peach trees; and if a potato crop makes $10.00 per acre, net, it is doing well, and in some cases we may get $20.00 or more net;

but should that be secured by the loss of one peach crop or one apple crop we have a very large contra-account; for the one apple or peach crop will probably be worth as much money to us as five potato crops. Then, again, when a man is working potatoes there is a tendency to sacrifice the trees, which does not happen when there is no crop being grown. Another point with us is that we need organic matter in the soil, and are not able to secure enough to grow profitable crops of potatoes unless we have a rotation of perhaps clover or meadow one or two years in four and the orchard does not lend itself very well to such a practice.

To return to our first question, that of cost of production, it might be wise to take one other crop as a sample. The U. S. Department of Agriculture has been determining the cost of production of certain crops in Minnesota and they find that it costs about $6.00 an acre for labor, teams, seed, etc., to produce a crop of wheat. This does not include any charge for rent. If now, the land be worth $50.00 an acre it would take $3.00 an acre to pay the interest on the $50.00; therefore, this is a legitimate rental and would bring the cost of production to $9.00. If the land be worth $150.00 an acre our rental would be not $3.00 but $9.00 and our cost of production would be $15.00. If we secure no more yield on the $150.00 land than we do on the $50.00 we find it would become unprofitable to try and grow wheat; for with an average yield of 14 bushels at $1.00 per bushel there would be nothing but loss; so that we may say that with our present mode of farming no man can attempt to try and grow a profitable average crop of wheat on land worth more than $100.00 an acre. He simply must cast round for some other type of farming. Our potato-growing involves a larger outlay for labor than wheat growing. The important thing to remember is that rent should not constitute more than a certain percentage of the total cost, so that any crop which involves considerable labor can be grown on higher priced land than a crop which involves little labor, and we find that potato-growing has its limit, that is, about $300.00 per acre. In other words, we cannot afford to pay more than $18.00 an acre rent for land for potato-growing, and with average yields, no man could afford to pay this. No 90-bushel crop of potatoes could afford such a sum, in fact, it could not afford to pay much more than $3.00 or $4.00 rent. Orchard land on the other hand, with the large amount of labor involved and large amount expended for packages, frequently running to $100.00 per acre or more, can pay a higher rent than potato-growing, and yet, not have the rent a higher percentage of the total expense. So that we are really trying to grow a crop of fruit trees which will warrant the expenditure of a considerable sum of money in order to secure returns as soon as possible, and, at the same time, trying to devote part of the same land to a crop which will not warrant any such expenditure. This, however, is but one way in which the two crops conflict. The growing of potatoes gives no opportunity for the incorporation of a large quantity of organic matter.

I would like to give the figures which have been issued by the U. S. Department of Agriculture in regard to the cost of growing potatoes without fertilizer in Minnesota.

The statistics given in the table were collected from a large potato and grain farm in Clay county, Northwestern Minnesota, where 300 to 400 acres of potatoes are grown annually. During the years 1902-7 no fertilizers were used. These figures allow no charge for superintendence, which might be permitted to pass on a small farm where the farmer worked himself, but would be a factor on a large farm.

COST OF PRODUCING POTATOES ON UNFERTILIZED LAND

Seed (12.1 bus.)	5.804
Plowing,	1.190
Harrowing,	.184
Cutting seed,	.801
Planting,	.620
Weeding (horse weeder),	.544
Cultivating, 3 times,	.294
Spraying, 3 times,	.294
Paris green,	1.282
Bluestone,	.528
Digging,	1.338
Picking up 127 bus. at 3½ per bu. and board,	4.806
Hauling and storing,	2,603
Machinery cost,	596
Land rental,	3,000
	26.366

The actual cost of production was 21 cents per bushel. It is not stated whether the above yield was total crop or saleable, but if the former then the actual cost of saleable potatoes per bushel would be nearer 30 cents than 20 cents. I think you will agree that this cost is low.

COST OF PRODUCING POTATOES ON FERTILIZED LAND

Spring plowing,	1.017
Harrowing, 4 times,	.765
Cost of seed (14.1 bus.),	8.472
Cutting seed,	.376
Treating seed,	.120
Corrosive sublimate,	.277
Planting,	.689
Fertilizers,	6.500
Weeding, twice,	.327
Cultivating, 3 times,	1.814
Spraying, 4 times,	.446
Paris green, Lime, Bluestone,	1.833
Digging,	1.810
Picking up 162 bus. at 3½c per bu. and board,	6.362
Hauling, storing and sorting,	3.317
Machinery cost,	.596
Land rental,	3.000
	37.721

The interesting thing, however, is the fact that even when fertilizers were applied the cost of growing a bushel was greater by 2½ cents per bushel than when no fertilizer was applied. The increase was not sufficient to pay for the cost of the fertilizer. Another point is that not all of the gain is saleable. I do not suppose the saleable potatoes were produced for less than 30 cents per bushel. Do you think you can produce them for less? This

last year in New York State we are being offered anywhere from 25 to 35 cents per bushel for our potatoes. You cannot grow them for that money; our yield is not high enough. If you secure 100 bushels per acre of which 80 are marketable and you get 50 cents per bushel you have $40.00 per acre. Personally, I cannot grow potatoes for less than $50.00 per acre, and the Maine Station find that it costs them $69.00 per acre, but under their conditions even this expenditure was profitable at 50 cents per bushel, but not at 30 cents.

TEN-ACRE FIELD

Plowing at $2.00 per acre,	$20.00
Harrowing, 5 times, $3.00 per acre,	17.50
Fertilizer (home mixture), $30.00 per ton,	225.00
Seed (130 bus.) at 75c per bu.,	97.50
Disinfecting seed (labor and material),	3.00
Cutting seed (by hand) at 6c per bu.,	7.80
Planting, team and 2 men, 3 days, $5.00,	15.00
Harrowing or weeding before crop is up, 4 times,	10.50
Cultivating crop, 8 times, at $3.50,	28.00
Spraying, 6 times, ($1.00 per acre each application),	60.00
Hand hoeing and pulling weeds once (if necessary),	15.00
Digging and hauling to storehouse or station at $15.00 per acre,	150 00
Rent of land (5 per cent. on $50.00 per acre value), 10 acres,	25.00
Depreciation of implements (plows, harrows, planter, sprayer, digger, etc.), value $250.00 at 10 per cent,	25.00
	$699.30

Value of crop, 225 bus. per acre, (2,250 bus. at 50c),		$1,125.00
Value, per acre,	$112.50	
Cost of growing, per acre,	69.93	
Net profit per acre,	$ 42.59	

It will be seen that it cost 31 cents per bushel to produce the above crop. Just determine the actual cost and see if the business pays, whether it is worth bothering with. If it will not pay to grow potatoes alone it will not pay to bring them into the orchard.

There is one other question and that is in regard to the supply of seed. Whenever you put more labor on a crop or you put more time in spraying or apply more fertilizer it must be paid for, but it costs no more to plant a potato which is capable of giving 200 bushels per acre than it does to plant one whose maximum is 100 bushels. We know there are individual potatoes whose maximum yield is, say one pound, and there are others which can give us five pounds, and yet occupy no more land. It would seem to me that if one is going into potato-growing it is necessary to grow some of the best individuals. I do not say best varieties, because in my experience, there is just as much difference between the yields of individuals in a variety as there is between the varieties themselves. Therefore, I would urge you to consider this question. The ability of the individual to produce a crop can be determined by trial. If you select 1,000 good potatoes or 500 the method of operation would be about as follows: Take a piece of land no better or worse than the average and prepare it the same as for the rest of the crop. Prepare to plant by hand. Take the tubers to the field, having them, say 8 ounces each, so that they will make 4 nice sized sets. Plant them, probably 15 inches apart in the rows and leave a space of 18 or 20 inches between each four, that is, each individual potato

will make 4 sets and will give you four plants. If you have 1,000 you will have 4,000 hills. By leaving a little space between every four there will be less liability of mixing when digging. Cultivate and spray the crop as you have done before and plan to dig it by hand, throwing the four hills from each individual together so that it will make a thousand hills. Now, carefully go over each and throw out all the poor hills. Put all the good ones into individual bags or weigh them in the field, probably 10 will be found to produce a heavier yield than any others. These should be kept by themselves and all of the crop planted in a row, so that we have 10 rows, each planted with the progeny of one individual. If they continue to yield well these can be saved, but probably one or two may lose vigor. They will need be dropped. Those which hold up can be kept and put into a multiplying plot until enough can be secured for seed. If this be kept up each year one will increase the productive power of his strain of potatoes. It has been shown by this means that the yield can be increased considerably. There is one difficulty which immediately comes in in regard to the fruit grower turning potato grower. He probably intends to be a fruit grower and is merely using potatoes as a stop-gap for a little while, and therefore, it does not appeal to him to go ahead and reach the summit of the potato-growing profession, and it may not appear to be worth while to undertake such a piece of work as this outlined. This is one of the difficulties of the situation and one of the reasons why I feel that I cannot look after more than one or two things and need to contract rather than spread myself out over more. To be a success all one needs is to be able to grow one variety of one crop better than anybody else.

There is one other problem, that is the securing of a good saw for pruning. We have had considerable difficulty but think we have a good tool now in the No. 20 Disston Pruning Saw. It is a modified No. 7 Ship Carpenter's Saw, which this firm has kindly changed at the suggestion of myself and others. We think it is a good tool. At the point it is but an inch wide, the back is hollowed; it is 26 inches long and has the largest handle ever put on a saw, so that a man can use it with his mitten on his hand.

CO-OPERATION IN MARKETING APPLES

BY HON. S. L. LUPTON, *Winchester, Va.*

Your president has invited me to talk to you this afternoon on "Co-operation in Marketing Apples," and, as on day before yesterday, I think I will ask to modify the program and call my talk, "Co-operation in Orcharding." Co-operation extends all through the business of orcharding, not only in the marketing of the fruit but in the growing of the orchard as well. I do not know just

why your president wanted this discussion this afternoon unless because you have failed, in your attempts at practical organization as we have done in Virginia, or unless you have tried and succeeded, as we have not done in Virginia. Mr. Cohill thinks the small apple grower will be put out of business by the large company or syndicate orchards. I believe that, if his business is properly managed, the small fruit grower will, in the future, raise the best fruit and secure the larger returns, provided he secures proper organization.

There is quite a difference between fruit growing and ordinary farming. Most farmers consider fruit growing, to some extent, as a side issue. In the first place, if any of you gentlemen have 50 bushels of wheat or a load of corn to sell, you bring this grain to the market and you are certain to get the market price for that produce. You know the price of timothy hay. No matter how small your crop may be, and no matter how little pains you have taken to ascertain the price, you get the market price. That is not so in fruit growing. You raise your crop of fruit and you are ready to sell it, then it becomes at once a battle of wits between you and the buyer. You are at a loss whether to store, to sell it to a local buyer or ship it yourself. You have no notion where or to whom to ship. When you decide where to send the fruit you will likely strike the lowest market.

Let us see in what way a fruit growers' organization can help us leaving out of consideration for the moment any question of selling the fruit.

A number of you may be planting trees in the near future. You have no co-operation.

Each man is selecting his own orchard site and his own trees. What mistakes is he likely to make? First the mistake of location. What way could co-operation help the orchardist in selecting a location for his orchard? I take it that perhaps you may have 150 acres of land and that you probably wish to plant part of that land in fruit trees. Whose advice are you going to take? It seems to me the question of location is such a very serious matter that it is going to involve your whole career as a fruit grower. If you have expert advice here in your county, well and good. The chances are, however, that you do not have. Perhaps some of you do not agree with me in what I am about to say, but in view of the grave mistakes that I have made, I am very slow in taking any serious steps in advance without the advice of the Department of Agriculture, or the Experiment Station. Are you able as individuals to secure the services of an expert in soil conditions to come here and locate your orchard for you? You *would* be in position to secure such advice if ten, twenty of fifty of you need his services at the same time. You could not secure such help without an organization.

Suppose, again, after selecting the site of your orchard, you are troubled about where to buy the trees. What you are most interested in is getting a sound, healthy tree. You are pestered to death by people who want to sell trees. You do not know whether to buy from a local nurseryman or from a nurseryman outside of the county or state. What are you to do? Send for an expert again. Have this gentleman go to the nursery and select the trees.

The large fruit grower can afford to do this. The small fruit grower cannot.

I have been extremely fortunate in this regard, having spent the last twenty years in Washington. I have been able to secure the help of these men in my own individual work as I could not have secured it otherwise. The Government has a small experimental orchard plot on my place, where they have been experimenting three or four years. They tell me what fertilizer is to be applied, the cover crops to be put on the land and tell me how to treat the trees.

The result of that experiment on my place has been an eye-opener to me. A year ago the fruit growers in the immediate neighborhood around Winchester held a field meeting in my orchard along in September. It was a most satisfactory meeting, and we were very much gratified indeed, that a great number of ladies came out from the city of Winchester.

When Dr. Waite wanted the experimental block in my orchard I told him I would rather he would take some other man's orchard, because I did not want to be bothered. But, owing to certain conditions he thought he found there, he wanted to secure my place. The benefits have been so far in excess of any trouble that it would not do to mention it. After that meeting our fruit growers began to see things.

After we started picking apples it occurred to me to try an experiment. Our apple pickers, about fifty in number, were just ordinary laboring men, some could not read or write. Men who came down out of the mountains to help pick apples. I said to Dr. Waite, I am going to get all my laborers over here and let you lecture to them just like you did to the fruit growers. Dr. Waite has a very peculiar facility for expressing himself, so that any sort of intelligence can understand him. When the lecture began I saw at once that the men were intensely interested and every one of those men are better apple pickers to-day from that experience. They asked intelligent questions and seemed to understand what was going on. So much for expert information.

The small fruit growers get anxious about selling, they do not know what they will get for their fruit. They want to sell just as soon as they can. One of my neighbors will sell his apples on the 20th of August no matter what the price. If three or four more do that it breaks the market for the rest of us. It is customary with us to sell the fruit on the trees before picking time, usually contracting for the sale in August or September.

One year when ten or twelve of us had about 25,000 barrels, and we tried to organize, all we could get the growers to do was to sign a paper agreeing not to sell their apples before the first of September. After seven or eight or ten of us had signed up controlling 20,000 or 25,000 barrels of apples, we carried that paper around the neighborhood to get some others not to sell their apples. The other growers said "No, we will not do that. We won't sign up with you because we may not be ready to sell when you are ready and we do not know whether we want to take the price you do or not."

Then everyone of those small growers subsequently did individually, what they refused to do collectively, that is they said, "Those fellows have a big lot of fruit tied up until September 1, and we will just wait until they sell and we will get just as much as they will and not tie ourselves up either." Nobody did sell until after the 1st of September. There were 60,000 barrels of apples sold on that one day. When the buyers had bought our apples they claimed to have enough apples, did not want any more. Then there was a stampede amongst the little fellows. They could not sell their apples at our price and the majority had to sell for considerably less than the apples we sold on the first of September. We received $3.50 to $3.65 in the orchard, and some as high as $4.00 to $4.25. We got a good, round blessing on account of our combine, and could not get a single man to sign up this year.

Another thing happened that ought to be interesting. A gentleman came to see me at Washington, to organize an association of fruit growers. The result of his visit to me was the organization of what has since been known as the Virginia Fruit Growers' Exchange. About the same time there was organized, in the upper end of Virginia, the Shenandoah Fruit Growers' Association. Between those two associations, the one in the upper end of the valley, and the one in the lower end, there was 100,000 to 120,000 barrels of apples tied up. The result of this co-operation was that the apple prices sprung from $2.25 and $2.50 to $3.00 and $4.00, although the two organizations really controlled very little fruit.

You gentlemen are very much interested in spray materials at this time. I found you talking exactly like our own people talk. One gentleman was asking the price of some brand of material. Another was asking what his neighbor was going to pay for "Scalecide." Another one what his spray machinery was going to cost. So many people talking about the price of things and so few about the value of things. I wish our people would talk more about the value of things and less about the price. Fruit growing is not a cheap man's job. Why could not an organization help us in buying our spray material and machines.

One of the things all of us of this section need most, is the co-operation of an organization that will confine us to a standard pack: Let us forget that we are going to sell this fruit at all. Get up a series of co-operative organizations. Have delegates of every organization meet together and decide what the apple pack would be.

Down in Virginia the apple buyers come from New Orleans and New York. Ten to fifteen were there in one season. Six were there yet when I left on Tuesday, of this week. One man came bringing five or six men with him and planning to hire fifteen or twenty more. Before we knew it he had picked up six, eight or ten of our best workmen, and boomed the price of our labor. It has gotten so now that it is difficult to get experienced help because these apple buyers pick them all up. An efficient organization could own or at least help this situation.

I believe I am the only grower in Frederick county who does not have a man representing the buyer come in his orchard to superintend the packing. Under no circumstances will I have another man to come in my orchard to superintend my work. So

far as I know, every man in the country permits a buyer's representative do this work. Please consider that these questions have nothing to do with the price. Forget price for the moment and remember that if we grow the right sort of fruit and put it up right it will sell itself.

We know what a tremendous development in fruit growing is taking place out in the Pacific Northwest. It may be a great deal bigger from this point than if we were out there, but we know something about the character of their fruit, and the only thing that makes fruit growing possible in that country is the close effective organization they have perfected.

The object is to put the small fruit grower on the same level with the large one, and by combining to standardize the packing and grading of fruit. I am quite sure that there is no sort of disposition on the part of any of our people large or small, to be jealous. We should get together for the one purpose of standardizing fruit packing and packages of this whole eastern country, and you can't help but succeed, you can't help but realize the profits from such an organization. I do not know anything that has so injured the fruit business as the disposition, not only of the growers, but the buyers who are just as bad, to deceive the public by putting good apples in the end of the barrel and bad ones in the middle. I never saw a barrel of apples fixed up in that way until some fruit buyer showed me how to do it. Please understand that I do not claim to be any better or more honest than my neighbor. This is not so much a question of morals as of plain business common sense.

Last year I had a printed guarantee put in the package. The apples were uniform throughout the package and so guaranteed. I made a bargain that it was to be done that way yet during the picking season the buyer came out to my orchard a half dozen times insisting on my not putting that guarantee in the barrel. He said my apples were no better than other peoples apples, which was probably true and that the guarantee would interfere with the sale of the fruit he bought from other people. Maybe this will be true also but the guarantee goes in the future.

It is going to take a year when we people here in the East, can't get but 75 cents or a dollar per barrel for our apples, and perhaps not that to make us organize. Then we will begin to sit up and take notice, but as long as we can get good prices for our apples then we are going to feel as independent as we have been feeling. But you certainly can get together on these other propositions that I have mentioned. I do not want to take up too much of your time because there are other gentlemen to speak, but let me express the hope that you will not understand or think that I have come to Pennsylvania to teach you a lesson. We have been in the business longer and the truth of the matter is we are having too good luck. We would be better off, in some respects, if we did not have such good crops and such good prices, although I cannot say that I hope there will be a change in this respect. I have come here simply to tell you our own troubles, and I could like nothing better than to have some of you gentlemen to come down next year and tell us you have an organization that is doing something, doing good work.

If anything that I have said can hasten that moment and bring it to anything like a success, you will rise up and call me blessed in the lean years which are sure to come and which without organization will find you unprepared when they do come.

PEACH GROWING IN MARYLAND

BY AARON NEWCOMER, *Orchardist, Smithburg, Md.*

I would like to ask how many peach growers there are in the audience. Please hold up your hands. Quite a few. I want to say this, but not in the way of flattery, if you can grow peaches as good as the apples you have here on exhibition you have a fine peach country. It looks to me as if you have good peach soil, one that will give the fruit high color and excellent quality and that is the only kind that it pays to grow. I have been growing peaches for about eight years. Naturally some mistakes have been made but I feel that we have learned some things that are of value to us. They may not apply to your locality. In selecting a site for a peach orchard I would first consider the elevation. I prefer an altitude of from 725 to 1,000 feet above sea level.

SOIL ADAPTATION

Another important matter to consider is soil conditions. For myself I would want one of three soil types; either sandstone with a clay subsoil or a black slate with clay subsoil, or a deep chestnut slate soil with a mixture of sandy loam and clay as a sub-soil. I believe peaches will *not* do well on a rocky shale soil. I do not mean that peaches will not grow on other kinds of soil only that I have found the ones mentioned best for me in the order named. I traveled in five states two years ago prospecting for peach soil and finally came back to our South Mountain district. We have the best soil and the best elevation. Peaches can be grown in the Southern states but they do not have the flavor of ours. It is understood by a great many people that peaches will do best on a poor soil. I prefer the best I can get of one of the types mentioned. It is possible to grow peaches on poor soil by fertilizing pretty well and growing lots of cow peas, crimson clover or red clover as a cover crop to turn down, but if the soil is naturally rich we avoid that expense.

PREPARING GROUND FOR PLANTING

I like to plow the ground deep, 8 to 10 inches, being careful to do a thorough job. It is then well harrowed with a spring tooth harrow, until a good seed bed is secured. The field is scored one way with a shovel plow making the furrows 17 feet apart. It is

then marked out the other way with a barshear plow with furrows 20 feet apart setting the plow to run as deeply as possible. The trees are set exactly on the cross mark. Quite a few growers plant closer than 17x20 feet but we have learned that a closer planting it not best. One of my orchards was set 17x20 and another 18x18. We find the 17x20 best. It is convenient to spray and cultivate and later will have plenty of air and sunlight.

SELECTION OF TREES

It is quite a problem to know where to get exactly the kind of trees you want, of the right variety, true to name, healthy and vigorous. You should know your nurseryman. I prefer a tree 3 to 4 feet or an early budded, June bud 3 to 4 feet if it is grown in the Southern states or southern nursery. Examine your trees carefully before planting to see that they are healthy and of right kind. You cannot always tell about the kind but can almost always distinguish between a white and yellow peach, by the bark. A white peach will have red bark on one side and dark purple on the other, while a yellow peach will have a rather bright yellow bark on one side and a reddish-brown on the other.

VARIETIES

If you are planting a commercial orchard in Adams county or in Frederick or Washington counties, Maryland, and wish to have a succession extending over a period of about 60 days I would not select over 8 to 10 varieties. If possible you should have enough of a variety or be able to combine with a neighbor so as to make enough to ship carloads. To do this, if you have 1,000 trees of a variety you can pick over 500 of them on alternate days. You can always do better in selling at home or in shipping if you have carloads. With only local lots you are at the mercy of the commission man unless as suggested before you can co-operate with neighbors to load full carloads. I think co-operation is one of the important things for the orchardist. Then if there is a good man at the selling end he can divert the cars after shipping and place them where they will bring the most money. For a succession I would use Greensboro, Carman, Hiley, Champion, Slappey, Belle Georgia, Captain Ede, Elberta, Late Crawford, Mathews Beauty, Munson Free, Fox Seedling, Geary's Holden, Klondyke, Salway and Iron Mountain. Salway does well high up on the mountain slopes where it does not mildew. Do not plant September peaches below 750 feet elevation if you wish success.

PRUNING

Before planting I trim the roots that are broken and cut back those that are very long so as to make them uniform, always being careful to make the cut slanting on the under side of the root so that the cut surface will come into contact with the bottom of the furrow. It will callous over more readily and soon send out small feeding roots. If trees are planted in the Fall we do not trim

tops till the following spring. Spring planted trees are pruned as soon as set. If a low-headed tree is desired, cut back the main stem to ten or twelve inches. If a high-headed tree is preferred cut to 28 to 30 inches. As the tree grows during the summer cut off all but 3 or 4 of the main branches which should be used for the future frame work of the tree. These main limbs should be trained to grow as nearly at an angle of 45° as possible, then the trees will be easily sprayed and the fruit can be nearly all picked from the ground without the use of a stepladder. All centres should be kept cut out to admit sunlight.

CULTIVATION

The first and second years after planting the orchard, I plow it with a barshear plow following with a spring tooth harrow and plant to corn, potatoes or cantaloupes, to make the orchard self-supporting till it comes into bearing, which is usually the third year after planting. The following years, when the orchard is in bearing, we give only shallow cultivation with a spring tooth or disc harrow. This cultivation commences as early in spring as possible so as not to endanger bloom and tender fruit, in case of cold weather. We cannot begin much before March 20th without danger. On one occasion I had part of an orchard harrowed when the weather was cold and had a lot of damage on the cultivated part and none on the other portion. The cultivation seemed to lower the temperature to the danger point. We continue the cultivation every four or five days until the 15th of July. In this way a fine crop of peaches can be grown and a lot of strong hardy fruit buds developed for the next year's crop.

MAINTAINING FERTILITY

I believe in fertilizing the trees well. A fertilizer which contains 2 per cent. of Nitrogen, 8 per cent. of Phosphoric Acid and 10 per cent. of Potash seems to be a good balanced fertilizer. I use from 500 to 1,000 pounds of this mixture per acre annually, commencing the second year after the orchard is planted. As a cover crop to assist in maintaining fertility I use crimson clover, winter vetch and cow peas. These add much in the way of humus or vegetable matter.

SPRAYING

As a remedy for San José scale I would use home-made Concentrated Lime-sulphur solution—15 pounds Sulphur, 20 pounds Lime or some good brand of Concentrated Lime-sulphur made by a reliable firm. I tried Scalecide and Target Brand Oil on a large scale and it nearly put us out of business. Quite a lot of trees were killed and a lot more were injured so that it will take some time for them to recover. You cannot grow peaches without spraying them well. As a summer spray for fungus diseases we have been very successful with Bordeaux mixture—2 pounds Blue Stone, 6 pounds Lime to 50 gallons of water. We are thinking of trying some home-made Concentrated Lime-sulphur the coming summer.

THINNING

We always thin the fruit hard. One year took off over 4,000 bushels. We were at it three weeks. The neighbors said, "Newcomer is a crank," but we had nice fruit. By thinning the fruit so that peaches are from four to six inches apart on the limbs we grow fine large specimens for fancy packing which bring highest prices. If you are doubtful as to the wisdom of thinning try it on six Elberta trees leaving the next six unthinned and note closely the result at picking time. The improved condition of the present crop is not by any means the only advantage of thinning. Perhaps the most important of all is the protection of the tree against breaking as it is almost sure to do when overloaded, and against the robbing of vitality which would impair its future usefulness. Do not wear out your trees by allowing them to over-bear.

PICKING AND PACKING

When harvesting the crop, all fruit is hauled to the packing house. I very much prefer ladies to do the packing. Would not give a cent for a man to pack peaches for me. Never saw a grower yet who could pack peaches like a lady. She has more taste and neatness about it, and will put up packages that will sell for more money every time. We use the half-bushel Delaware basket and the Georgia Carrier. All fancy and extra fancy grades are packed in carriers.

SOILS OF THE SOUTH MOUNTAIN DISTRICT AND THEIR ADAPTATION TO VARIETIES OF APPLES

BY H. J. WILDER, *Department of Agriculture, Washington, D. C.*

It is difficult to describe in a half hour's time the adaptation of various kinds of soil to the many varieties of apples. We are not accustomed to talk about the soil even though trying to get our living from growing crops in it. We are not yet in the habit of thinking in soil terms. Some day we shall do this. And the growers of special crops, the fruit growers, the vegetable growers, etc., will be the first to realize the need for so doing. The numerous requests for soil facts that come to the Bureau of Soils from leading orchardists indicate that the desire for a much more intimate knowledge of the soil is already here. But meanwhile it is no easy matter to come at once to a common understanding so that a given statement means the same thing to all of us. So today I am going to talk first about soils in general leaving the matter of type adaptation until later.

In studying soils, as in other things, we begin by making a few large groups. This is commonly done by classifying the rocks from which the soils have been derived. Thus we have limestone

soils, sandstone soils, shale soils, granitic soils, etc., and in that part of the South Mountain district in this immediate vicinity you have many finer divisions, even, such as "white flint," "gray flint," "copperstone," "mountain stone," etc. A group of soils is designated by the soil series name. Thus the valley limestone soils were named the Hagerstown series because they were first mapped in the vicinity of Hagerstown, Md. And in similar manner other names have been selected to designate main groups or series of soils.

Leaving the stone content and the gravel content out of consideration we are accustomed to speak of soils as clays, sands and loams, or some combination of these terms such as sandy loams, clay loams, etc. What do these terms mean? Analysis of a true clay will always show that the per cent. of exceedingly fine particles is relatively high and where the amount is as much as 35 per cent. of the soil mass it gives to the soil a definite character, in fact seems the determining factor in the way the soil behaves when worked. If plowed or cultivated when wet such a soil will clod badly. Soils are sometimes found which analyze as much as 50 per cent. of clay, but I know of none so heavy in this state. A soil that would be mapped as a sand, on the other hand, is composed principally of particles much coarser than the grains of clay. Through such a soil water percolates rapidly and we think of it as a drouthy soil. Between these two extremes, then, of sand and clay, the coarsest soil particles and the finest there is a wide range of sizes. A true loam is a mixture of a large number of different sized particles. It is a medium mixture in which clay, medium and fine sands and silt are well balanced. When there is a little too much sand for this medium mixture of loam the soil is called a sandy loam, but where there is a little too much clay for the same classification the soil is called a clay loam. This phase of classification, as you will note, is based solely on the size of the soil grains, and determines the so-called texture of the soil.

But there are also stiff soils, mellow soils, mealy soils, and so on. This is brought about by a difference in the *arrangement* of the various sizes of soil particles. Two soils may analyze practically the same, *i. e.*, their textures may show no material differences and yet after a rain the one has to be dried out much more thoroughly than the other before it can be worked without clodding. This is due to the differences in the soil structure. Suppose we reduce this to fractions having a common denominator, as we used to do in school. Some of you have tried packing apples in boxes, and until experience has been acquired it is not easy to come out even. If all apples were of the same size it would be an easy matter. But there are all sorts of variations in size, and it takes patience to work out the best combination. Apples of different sizes have to be arranged to fill a given space, and there is almost no limit to the number of combinations that could be made if we did not assort and pack according to standard grades.

Now soil particles vary as much in size, relatively, as do apples, and hence the soil mixture is exceedingly uneven. All sorts of combination packs have been made and in some of them the particles fit together so snugly that they do not readily crowd apart when a little rootlet tries to find its way down among them. And remember that in plant and tree growth a tiny rootlet always has

to blaze the path downward into the soil, the big strong root being a later development. Stiffness, or its opposite mellowness, depends upon the *arrangement* of the soil grains and not upon their *size;* upon the structure, not upon the texture of the soil.

Contrary to common opinion the most clayey soils are not the stiffest soils. Bricks are not made of clay alone, but of a rather definite mixture of clay and particular grades of sand. Sometimes we find subsoils that approach in varying degree a bricklike composition. If brought to the surface by the plow, exposed to the air and left undisturbed for a short time the clods bake, and then are reduced with much difficulty. This could be prevented at the surface if the harrow had followed the plow closely, and if stable manure or other organic matter had been mixed with the soil, but a deep subsoil of this sort is not so easily improved nor is it inviting to a well-branched fibrous root system. The root systems of some varieties of apples, furthermore, overcome a stiff structured subsoil much more successfully than others. In one of the large orchards of the southern Ozark country Ben Davis trees failed in certain spots. They were very unthrifty and not infrequently died. Yet elsewhere in the same row, with identical slope, exposure and treatment the trees were in excellent condition, and bore heavily. The owner believed, too, that there could have been no variation in the stock. An examination of the subsoil showed it to be exceedingly stiff wherever the trees were effected. Following this cue throughout the orchard it was found that another variety (Mammoth Black Twig) was not effected at all by the stiff subsoil as the roots forced their way down through it, and the trees showed excellent growth. Not satisfied that the chemical condition of the soil in this case might not have some influence upon the unthrifty trees I had made chemical analyses of these soils, but the results showed that there were no chemical differences worth noting. In this particular case it was apparent that the Ben Davis would not thrive on so stiff a subsoil, whereas the Mammoth Black Twig could successfully overcome it.

I do not need to call your attention to the self-evident fact that the condition of this subsoil was not amenable to practicable improvement by the addition of humus, notwithstanding the fact that by this means surface soils may to some extent be changed. In a less pronounced case the growth of deep-rooted crops such as the legumes would have greatly improved the physical condition of the upper subsoil, but once the orchard is planted, or at least after it has reached bearing age, the practical orchardist will hardly try to leave cover crops under his trees so many months of the growing season that their root systems will be sufficiently developed to add humus to the lower subsoil. Yet the roots of a well-developed apple tree reach far into the subsoil.

The roots of plants and trees do not get their moisture from free ground water, *i. e.*, water that may flow out in surface streams and underdrains, but from the thin films of moisture that surround every soil particle. This moisture is called capillary water. A tree can get no plant food from the soil except as it is obtained in dissolved form, not in free ground water but in the soil film or capillary moisture. Hence the importance of the texture and struc-

ture of the subsoil, as well as that of the surface soil is at once apparent.

I have indicated some of the main factors considered in the study and classification of soils. When studying soils in the field we follow out the crop results as related to and depending upon the soil conditions. Thus we are enabled to compare crop results as influenced by a large number of soil variations and to draw some conclusions in regard to the adaptation of certain soils to certain crops and to different varieties of the same crop.

Having dwelt at some length upon the importance of soil selection, I want to call your attention at this point to the fact that the character of the soil upon which a crop is grown is only one of several factors necessary for successful crop production. Climatic conditions embracing not only absolute temperatures, but also the rainfall, air drainage, soil drainage as influenced by topography—the only kind considered until recently—elevation both above sea level and with reference to local topography, fertilization, and care of orchards are all important. No one of these factors may be studied effectively unless the other factors influencing production can be balanced. So soil comparisons can only be of value when the other conditions are equalized, and to do this a large number of field comparisons is essential. The adaptation of varieties of apples to types of soil can be studied with hope of arriving at definite results only by considering first the behavior of specific varieties upon specific well-defined types of soil.

In the South Mountain region you are somewhat restricted in the number of commercial varieties of apples that have proved to be both hardy and profitable, and that possess at the same time as good quality as a group of growers of your standing wishes. There is nothing strange in this for until recently we have always been satisfied with whatever varieties we might have, hence little effort has been made to test other varieties under local conditions. Barring a few sections in the eastern United States which seem to have been blessed with varieties to fit their conditions without much effort on their part, growers are seeking to-day additional varieties that will yield well and also be of high quality. York Imperial has been the money-maker in your district, and until you have more profitable sorts of better quality than you now have, it must continue to occupy an important place in your commercial plantings. The York apple has been severely arraigned because of poor quality, and as sometimes grown the reputation is in some degree merited; but on the other hand, it is a very good apple when grown at its best, and at least has nothing to fear from such as the Ben Davis group.

If the tendency of the York to be coarse in texture could be in some degree overcome an important advance would be made. As grown in some parts of central Pennsylvania where the climate is a little colder than in the southern part of the state its texture is much finer, and in following this variety to its northern limits where superseded by the New York varieties, the flesh is much closer, more solid and compact than with you, but the apple is not so large. There are several good sorts moreover, to take its place there and so it is not planted to any great extent. You cannot

bring that climate here, but you can select those subsoils which have such water holding capacity that their temperature will make up in part for those climatic conditions, and thus be of material assistance in growing a finer textured York apple.

Dr. Voorhees in an address to the New Jersey Horticultural Society last year (see page 153 of New Jersey Horticultural Society, 1909) said he thought color to be largely dependent on climate and sunshine, but to some extent the presence of iron might assist. In hearty accord with this it seems to me that attention has not been called to one of the most important factors, unless Dr. Voorhees meant to include it under the general heading "climate," and that hardly seems probable. There are certainly two conditions of climate in which every tree finds itself trying to grow, viz., the one above the sruface of the ground and the other below. The former is much easier to observe than the latter, and to it much thought and study have been given. But soils vary greatly in their capacity to hold water, and this variation depends largely upon the texture of the soil, *i. e.*, upon the size of the soil particles.

But the structure of the soil also plays an important part in determining in many cases the moisture conditions, though that is not necessarily its most noticeable effect on tree growth. Soil temperatures depend largely on the water-holding capacity of the soil. The soil particles warm up in the spring much more readily than the water contained in the soil. So does the humus, but the relatively small percentage of it in any good fruit soil makes it a factor of lessor importance as far as its temperature is concerned. Consequently a soil that holds the most water is the last in the spring to become warm enough for the planting of crops. Hence we commonly call a sand a light soil because it is ready ot work early in the season, whereas clay is considered a heavy soil because it retains moisture well and cannot be worked until later. As a matter of fact, the opposite is true so far as the weights are concerned, a given volume of sand weighing more than an equal volume of clay.

If, then, subsoils well-drained from free water be selected within the York region that carry a maximum of capillary water their temperatures will be sensibly lower, especially during the midsummer months, than those of lighter textured subsoils that carry less capillary water. In this way slight check to rapidity of growth may be effected and thus give to the fruit a somewhat finer texture.

To obtain, then, the best quality of York Imperial consistent with heavy yield and good exterior appearance this variety should be planted, I believe, on a heavy well-drained soil. A mellow clay loam surface underlaid by clay loam or even clay in this region, so long as it is not stiff enough to prevent the ready penetration of the roots, would be particularly desirable. The elevation of South Mountain above the surrounding country is undoubtedly a desirable factor, though its superiority over the lower slopes of the same range could hardly be very marked where the soil condition are equalized.

There are no soils in this vicinity too heavy for the York Imperial. Hence I would suggest that the heaviest or most clayey soils be selected for this variety, where drainage is good and at the highest local elevation available. The Cecil soils as mapped in

the Adams County Soil Survey, especially in the northern part of the county, the heavier parts of the Porters loam and the Porters stony loam, the Mont Alto loam and stony loam are very desirable, and the heavier members of the Leesburg, the Duffield, the Hagerstown and the Penn soils where the elevation is sufficient are also good, ranking in the order named. The Mont Alto, Leesburg and Duffield soils were not mapped in Adams county, but they occur not far north and west of South Mountain, and have been mapped this season on the Reconnoissance Soil Survey of South Central Pennsylvania.

The Stayman is so near the crest of popularity at the present time that it is being planted extensively in many parts of this state regardless of conditions, either of climate or of soil. It is undoubtedly a very desirable acquisition to the list of varieties suited to this immediate vicinity and in general to southeastern and central Pennsylvania, but I doubt whether it is any more cosmopolitan as to soil and climatic conditions than several other well established sorts, such as the York and Baldwin.

The Stayman has given its best results, as observed up to this time, on soils of medium texture that are not above the average in productivity, and on medium to heavy sandy loams. The tree is naturally strong in growth hence its vegetative habit should not be intensified by an excessively rich and productive soil. The color of the fruit is very liable to be deficient, hence moist rich loams and clay loams should be carefully avoided. The variety has shown a tendency this year to crack open just ahead of picking season, and while the damage has not been heavy, neither is the indication reassuring. Very likely this tendency is due in part to weather conditions of the present season, but I want again to call your attention to the climatic conditions maintained by the soil and subsoil, especially the latter, and that the roots of a tree are in a very definite climatic environment which is locally controlled largely by the water-holding capacity of the subsoil. The latter in turn depends principally upon the texture and structure. The bursting of apples on the tree is generally attributed to a too rapid growth except as it may be a varietial tendency. Early seasonal growth is obtained on sandy soils, but the strongest vegetative growth the season through is obtained from rich moist loams. From such soils large apples may be obtained but the color is inferior. For these reasons, then, would I select soils for the Stayman as previously described. In the Porters soils the lightest areas that are also the most thoroughly drained are to be preferred. The highest elevations in the Penn loam and Penn shale loam should also give very fair results. Where Mont Alto soils are to be used the lightest of this series available, or the heavier areas where well drained, will undoubtedly give a well-balanced growth of tree and fruit. On the other hand, the Mont Alto soils of medium texture that are more highly productive seem especially well adapted to Grimes, a variety that needs encouragement in tree growth. The Porters and other soils a little heavier are also adapted to this variety. Grimes seems not sufficiently vigorous to overcome a stiff subsoil, although the subsoil must be clayey enough to maintain a steady supply of moisture. A mellow or plastic clay loam best supplies this condition, and the

fruit from such soils is slightly better in keeping qualities than that from lighter mellow soils. The soil requirements of the Grimes differ markedly from those of the York which will thrive on a much stiffer subsoil than the Grimes.

Jonathan holds a good deal of promise for this section. Its high quality and the strong demand for it when well grown make it a very desirable sort. As grown in the north, that is, in New York and in northern Pennsylvania, at least, its size is somewhat disappointing. In the southern Ozark country it is a magnificent apple. It is the one commericial sort which has been fully tested there that can compete in quality with Pennsylvania apples. In West Virginia it varies greatly in size depending on conditions. The tree has not a strong growing habit, and the further north it is grown the smaller the fruit, when grown under comparable conditions. A deep mellow warm soil such as the so-called Pine Lands the other side of South Mountain—named the Leesburg series during this season's work—is well adapted to the Jonathan. Carefully grown on a soil of that kind I believe a satisfactory growth of tree may be secured, and that the fruit will meet requirements both for size and for color.

Smokehouse is another sort of high quality that grows well on light to medium soils. The soil must be well drained, and if also somewhat porous fruit of better color is secured. Such a soil may be put in a productive condition, but care should be exercised in applying nitrogen as an excess of this element makes it difficult to secure good color.

I will mention three other varieties that seem well worth considering, though I have relatively little data concerning them. One of these is the Arkansas Black which is doing very well in some cases. It is dull in color but is fairly good in quality and has been profitable in some cases in southeast Pennsylvania. For it I would suggest medium to light soils in an experimental way; and similar soils will give very good results with the Stark. W. S. Adams, of this county, has had experience in growing the Stark on the Porters soils, and finds the color rather dull, but when grown at its best the Stark is dull in color, and it is not improbable that it may be grown fairly well in this section, especially on the Pine Lands. It has the advantage of keeping later than most other varieties except the York.

A third variety which has given fairly good results under conditions similar to yours is the Langford Seedling. The fruit is of medium size, red in color though a little dull, and it is fairly good in quality. If one cares for an apple of this type it is worth trying, especially on your medium soils at the lower altitudes, such as the Penn loam, Penn gravelly loam and Penn shale loam.

Good Baldwins are only grown where climatic conditions somewhat colder than yours obtain. These are found this far south only where higher altitudes compensate for the distance south of normal Baldwin conditions. This makes it possible to grow Baldwins at altitudes higher than yours along the Blue Ridge in northern Virginia. In both places it becomes a fall apple and as such is not as desirable as where it remains a true winter sort. In northern Pennsylvania, New York and New England where it is at home, this

variety is best grown on deep friable loams and heavy sandy loams with loamy subsoils. Farther south heavier soils are better. I hope you will soon find as a result of thorough tests a sufficient number of good commercial sorts so you will not need to use Baldwin, and I believe that in time this will be done. It is well not to try to beat the other fellow at this job, and that is about what you are trying to do in growing Baldwins.

Your President asked me to talk about local conditions so far as possible and this covers, I think, your most important varieties.

To illustrate further the range of soil adaptations to specific uses it may be worth while to mention the effect of soil influence on some other crops. In the Connecticut Valley of Massachusetts and Connecticut, for instance, the character of the soil has been the determining factor in crop selection. You will pardon me, I am sure, if I select to illustrate conditions there, my father's farm where most of my life was spent until 21 years old, and where I have been able to follow closely the cropping conditions and management until the present time. It is a long rectangular farm that is typical of soil conditions over a broad scope of territory.

The soils are all alluvial, the range in elevation is in only one case as much as 15 feet, and within any one of the soil divisions the surface is nearly level.

The fine sandy loam at the west end of the farm is the best type of soil for wrapper-leaf tobacco, though worthless for the production of filler leaf, hence a normal price is $150.00 to $200.00, or even more, per acre. It is also good onion soil but brings no more profitable returns from that crop than the loam at the east end of the farm which, with the same culture treatment gives a cigar leaf so much thicker and poorer in quality that no one longer persists in trying to grow tobacco on it. Hence, a relative price for this soil type is $100.00 an acre, where the location is in every way equal to the other. The silt loam in the middle of the farm is worthless for tobacco, mediocre for onions, and so used almost exclusively for corn and grass. As a result its price is $50.00 to $75.00 an acre.

It should be noted, too, that the best of the tobacco lands contain the very low organic content of 1.5 to 2.75 per cent., notwithstanding plentiful applications of stable manure. Hence the natural adaption of that soil does not depend, it need hardly be said, on the organic content; neither may other soils of that locality, such as the loam at the east end of the farm mentioned, be so amended by the addition of humus as to produce leaf satisfactory in quality. Yet it is just as favorable as the first for the growth of cigar leaf in every respect save that of texture and structure. Here, then, is a very definite illustration of how the physical character of the soil has not only been the determining factor in the selection of specific crops for the different types of soil on a given farm, and for a linear distance of at least 75 miles in two states, but these specific adaptations to special crops have in turn been the principal basis of land valuation there for the last half century.

This case is not unique. There are many cases in different states which illustrate the same principle of soil adaptation and definite

soil requirements for the best results. These are not theories but facts based upon and demonstrated by well-developed agricultural practices.

In view of these facts it does not seem strange that our fruits also should give a wide range of results as grown on different soils, and that equal results with a given variety of apple, for instance, are not obtained from diverse soil conditions.

26—7—1910

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OF THE

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Allegheny,	A. J. Purdy,	Imperial, R. F. D. No. 1,	1912
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Blair,	W. Frank Beck,	Altoona,	1914
Bradford,	F. D. Kerrick,	Towanda,	1913
Bucks,	B. Frank Wambold,	Sellersville,	1914
Butler,	W. H. Milliron,	Euclid,	1914

			Term expires.
Cambria,	Jas. Westrick,	Patton, R. F. D. No. 2,	1913
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Carbon,			
Centre,	John A. Woodward,	Howard,	1912
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Clearfield,	Peter Gearhart,	Clearfield,	1913
Clinton,	J. A. Herr,	Millhall, R. F. D.,	1914
Columbia,	A. P. Young,	Millville,	1912
Crawford,	J. S. Patton,	Hartstown,	1914
Cumberland,			
Dauphin,	Edward S. Keiper,	Middletown,	1914
Delaware,	E. J. Durnall,	Swarthmore,	1914
Elk,	John M. Wittman,	St. Mary's,	1911
Erie,			
Fayette,			
Forest,			
Franklin,	John P. Young,	Marion,	1914
Fulton,	J. L. Patterson,	McConnellsburg,	1913
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Juniata,	Matthew Rodgers,	Mexico,	1912
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Pike,			
Potter,			
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Somerset,	John C. Weller,	Rockwood,	1914
Sullivan,	J. G. Colts,	Campbellsville,	1914
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Union,	J. Newton Glover,	Vicksburg,	1914
Venango,			
Warren,	R. J. Weld,	Sugargrove,	1914
Washington,	D. S. Taylor,	Burgettstown,	1914
Wayne,	Warren E. Perham,	Pleasant Mount,	1914
Westmoreland,	M. P. Shoemaker,	Greensburg,	1913
Wyoming,	D. A. Knuppenburg,	Lake Carey,	1913
York,	G. F. Barnes,	Rossville,	1914

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PAPERS READ AND ADDRESSES DELIVERED AT THE THIRTY-FOURTH ANNUAL MEETING OF THE PENNSYLVANIA STATE BOARD OF AGRICULTURE, HELD AT HARRISBURG, PA., JANUARY 24, 25 AND 26, 1911.

REPORT OF THE COMMITTEE ON CEREALS AND CEREAL CROPS

By J. MILES DERR, *Chairman*

The production of cereals and cereal crops may be considered the greatest industry of the present day. On account of its importance to all classes of people it should receive a great deal of consideration. We have in our country several million acres of as fine land as ever kissed by the sun or tickled with a hoe. One crop from the farms of our great country would pay for all the railroad property of the United States.

Corn

Let us consider a few of the leading cereals produced in the United States: "Corn is King," and has been properly named on account of its importance as a feed and value of the product. It is by far the most valuable cereal we raise. Our corn crop is worth more every year than all we get from our gold, silver and lead mines. It has been estimated that our corn crop is worth more than twice as much as our wheat crop. Our annual corn crop averages more than two billion bushels of shelled corn every year. Corn is raised in nearly every part of the United States. Ohio has the highest average per acre, about forty-two bushels; Pennsylvania third and Florida lowest, about eleven bushels per acre. More than one-half of our corn crop comes from the seven great states: Illinois, Iowa, Missouri, Kansas, Nebraska, Indiana and Ohio. This is the greatest corn patch on the face of the earth. It produces more than one billion bushels of corn every year, or more than one-half our corn crop. Can we realize how much corn one billion bushels is. Suppose it would be loaded upon wagons, forty bushels of shelled corn to a wagon, and driving the teams so that the noses of each team would just reach the tailboard of the wagon in front of it, making a continuous train of wagons more than one hundred and fifty thousand miles long, or long enough to reach six times around the world. These seven states produce about one-half of our corn crop, and if we want to know how many wagons it would take to carry a whole crop, multiply the number by two.

What is done with this immense crop of corn? About nineteen-twentieth of it is fed to stock in this country. About one twentieth is shipped to Europe. Corn is the chief food of about forty million hogs raised annually in this country.

Wheat

Winter wheat may be considered second in value and importance. Wheat is one of the most important grains known to man. It has been used for ages by the people of the Old World. Wheat was not known in this hemisphere before the time of Columbus, and our continent now produces more wheat than any other grand division of the globe. The United States as a nation takes the lead in the production of wheat. A large percentage of the people of Europe eat bread made from our wheat. Millions of bushels of this grain every year cross the Atlantic, and, with the exception of cotton, we get more for our wheat from foreign countries than any other crop. Wheat is grown in nearly all parts of the United States, but our best wheat lands lie north of the Ohio and Missouri rivers. Let us note some facts about one of the largest wheat farms in our country:

On a certain wheat farm in North Dakota there are two hundred and fifty pairs of work horses and mules, two hundred plows, one hundred and fifteen harvesting machines, and twenty threshing machines run by steam. When the grain is ripe, four hundred men are employed to harvest it, and at the time of threshing there are six hundred men at work. Some of the fields contain 500 acres each. The men working in them labor in companies, under mounted overseers. In plowing the ground, scores of sulky plows, driven by men who sit on the plows, will move across the field together, plowing several acres each round.

Harvesting on these big farms is a wonderful sight. On such a farm as the one being described, the work of cutting and threshing is done at the same time by a combined harvester and thresher. Some of these great machines are drawn by steam engines; others by teams of twenty-five to thirty horses or mules. A single machine with four men will gather and thresh from seventeen hundred to three thousand bushels of wheat in a day.

The next question is, How is the wheat cared for after it leaves the fields?

This is almost as great a business as raising the wheat. At some of the railroad stations in the wheat belt, and at all the large grain ports of the United States, there are large elevators, or granaries, used for storing the grain until it is wanted for sale. A single elevator often has storage room for more than a million bushels of grain. The elevators at Minneapolis alone can hold almost thirty million bushels at one time.

The great wheat crop and the location at the head of navigation on the Mississippi River has caused two thriving commercial cities to be built, known as the "Twin Cities of the Northwest"—Minneapolis and St. Paul. They contain some of the finest business blocks in our country. The two cities now almost join, although their business centers are about ten miles apart. I have just described the greatest belt in the United States, and yet their average yield per acre would not satisfy many of our Pennsylvania farmers who

are accustomed to having average yields of twenty bushels per acre, and I have in mind plots of 15 acres and more yielding an average of thirty-two bushels per acre.

Oats

The oats crop of the country ranks third in importance. We produce about one billion bushels annually and it is worth three hundred million dollars.

Oats are produced in every state and territory in the United States. Iowa leads in the number of acres sown, Arizona the lowest. Utah leads in the average number of bushels per acre, being about forty-three bushels per acre, and Florida the lowest, with fourteen bushels per acre. Iowa produces the greatest number of bushels. Florida has the highest price per bushel, South Dakota the lowest.

Other Products

Next in importance is barley. California leads in total number of bushels produced, with about thirty-seven million bushels. California also leads in the number of dollars to her credit.

Rye comes next in importance. All but ten of the states and territories produce rye. Michigan leads in number of acres. Idaho produces most bushels per acre. Pennsylvania leads in total number of bushels. South Carolina has the highest average price per bushel, being one dollar and a quarter. Pennsylvanoa leads in the total value of rye, having to her credit about three and one-half million dollars.

Buckwheat is a very important crop, for several reasons: It is a quick crop and is in demand as soon as harvested; it can be produced on land that will not produce wheat, corn or oats successfully. Buckwheat is grown in twenty-four states. New York leads with 321,552 acres. Maine has the highest number of bushels per acre, about twenty-seven bushels, and Iowa the lowest, twelve bushels per acre. New York is the banner buckwheat state, her crop annually being worth three and one-half million dollars, or about one-third of the value of the buckwheat crop of the United States.

Flax, another important crop, is raised in this country for the seed which is manufactured into oil and meal. About two and one-half million acres are producing flax with an average of a little more than ten bushels per acre. In some sections during 1910 flaxseed was worth two and one-half dollars per bushel. In the production of flax, North Dakota leads in number of acres, the total number of bushels and value of its crop amounts to nearly fifteen million dollars.

Rice is produced in nine or ten states, with Louisiana leading in number of acres, 308,000, the greatest number of bushels and the largest total value, being nearly eight million dollars, which is about one-half the value of our whole crop.

The United States Department of Agriculture reports the total production of corn at 3,125,713,000 bushels as compared with 2,772,376,000 bushels for 1909, 27.4 bushels average per acre for 1910 as compared with 25.5 bushels the ten year average.

These figures seem large, and it is hard to realize how enormous they are, yet the latest census report showing the great increase in

the population of our country, and especially, the alarming increase in our cities, makes it apparent that the greatest problem before the farmers of our fair country at the present time is the conservation of soil fertility, and its economical increase. Another half century of the reckless and wasteful manner of using the soil, as has been done in nearly all sections of our country, will see the highest cost of living that has ever afflicted any nation.

The United States report gives a comprehensive view of the crop of this country. One of our local papers gives a little better idea of the intensive farming of Pennsylvania. It is as follows:

"GREAT FARM STATE. PENNSYLVANIA LEADS ALL THE OTHERS IN INTENSIVE FARMING. PRODUCED FIVE PER CENT. OF THE CROP VALUE ON LESS THAN FOUR PER CENT. OF THE ACREAGE." That the State of Pennsylvania is leader in intensive farming, the doctrine of which is being preached by the State College and the Pennsylvania railroad, is indicated by statistics just compiled by the Pennsylvania Railroad Company for 1910 which show that Pennsylvania last year had 8,384,000 acres in cultivation in corn, barley, buckwheat, hay, oats, potatoes, rye, tobacco and wheat. This is 3.503 per cent. of the total of 239,343,800 acres under cultivation in these crops in the United States, and the average value per acre in the State of Pennsylvania was $20.56 as compared with $14.53 for the average value per acre throughout the country. These figures are of special interest to the Pennsylvania Railroad, which in the past four years has been conducting an active campaign in the interests of scientific farming. Much instructive literature has been disseminated by the railroad company in pamphlet form, while farmers' special educational trains have been operated on various divisions from time to time. In this work the railroad company is co-operating with the State Agricultural Department and the State College of Agriculture. The Pennsylvania railroad recently announced that it had found its farming campaign a profitable one and that it intended to prosecute it vigorously during the present winter. Arrangements are being made for demonstrations and lectures to be given in various parts of the State of Pennsylvania. The country's total farm crop value of barley, buckwheat, corn, hay, oats, potatoes, rye, tobacco and wheat in 1910 was $3,478,417,773 and Pennsylvania's share of this was $172,362,500, or approximately five per cent. of the total, with only 3.5 per cent. of the acreage. Added interest is given to these figures in view of the fact that in 1909 Pennsylvania's acreage in the above crops was 3.547 per cent. of the total of the country, with the percentage of the farm crop value for Pennsylvania of 4.311, compared with 1910. Pennsylvania's percentage of acreage decreased, but her percentage of the revenue in these crops increased.

REPORT OF THE COMMITTEE ON FEEDING STUFFS

By GEORGE G. HUTCHISON, *Chairman*

To the Honorable Members of the State Board of Agriculture:

As your Chairman of Committee on Concentrated Commercial Feeding Stuffs, I beg leave to make you the following report for the year 1910:

With our new law that was placed upon the statute books by the last Legislature, which went into effect August 1st, 1909, we were in a position to proceed with our work with new courage. As stated to you in our last report, the old law was declared unconstitutional by Judge Tressler of Lehigh county. Our determination was to rid the State as far as possible of all feeds that were adulterated and falsely guaranteed. I hope to show you in this report that we have been in a measure successful, and that we have entered upon an epoch in the control of the sale of Concentrated Commercial feeds in Pennsylvania.

I would first call your attention to the condition that exists among the millers in our own State. Before the passage of a Feeding Stuff Law, a large number of them bought adulterants to adulterate their feeds, but at the present time, the majority of them are grinding whole grains, that is, corn, oats and rye. They do not compound or mix to any great extent. Rather, they buy their concentrated feeds from the large manufacturers in the West and sell them as they are received. The millers of our State still pursue the old practice of grinding ear corn, but this is not considered as good a feed as it was in former years, as hogs will not eat the chop which contains corn cobs unless they are ground very fine. I do not want to lead you to believe that our millers in Pennsylvania are perfect, but they are doing a business that is nearer the honest dealer than they did in the past. Our great supply of commercial feeds comes from Ohio, Illinois, Indiana, Wisconsin, Minnesota, Kansas and other Western states. Each has a by-product to sell. As we are the great market for feeds, they are all busy looking after their interests, and in this, I do not blame them, if they will give our farmers and stock feeders the worth of their money. The business of the Department of Agriculture, through its Secretary and his agents, is to see that this is done. The feeds sold in Pennsylvania showed a marked improvement.

As stated in my previous report, *I am still advocating the doctrine that all feeds should be sold on their protein and fat value and their low fiber constituency, or the higher the protein and fat and the lower the crude fiber, the more valuable the feed.*

Gentlemen, it is time for you to STOP, THINK and CONSIDER the great question of purchasing your feed supply on the basis that I have laid down to you. For your information, and that it may be convenient for you to refer to when you receive this report printed in the proceedings of this meeting, I have compiled the following table:

TABLE OF ANALYSIS

Name of Feeding Stuff.	Crude Protein.	Crude Fat.	Crude Fiber.
	Per cent.	Per cent.	Per cent.
Corn,	10.40	5.00	2.00
Hominy chop or feed,	9.80	8.30	2.80
Gluten meal,	29.30	11.30	3.30
Gluten feed,	24.00	10.60	5.30
Dried distillers' grain, largely from corn,	30.80	13.30	12.00
Oats,	11.80	5.00	9.50
Oats shorts,	16.00	7.10	6.10
Wheat,	11.90	2.10	1.80
Wheat bran,	15.40	4.00	9.00
Wheat middlings,	15.60	4.00	4.60
Wheat shorts,	14.90	4.50	7.40
Barley,	12.40	1.80	2.70
Barley meal,	10.50	2.20	6.50
Brewers' grain, dry,	26.00	5.60	1.40
Malt sprouts,	27.20	2.00	13.00
Rye,	10.60	1.70	1.70
Rye bran,	14.70	2.80	3.50
Buckwheat,	10.00	2.20	8.70
Buckwheat bran,	12.40	3.50	*21.90
Buckwheat middlings,	28.90	7.10	4.10
Buckwheat shorts,	27.10	7.60	8.30
Cottonseed,	18.40	19.90	23.20
Cottonseed meal,	42.30	13.10	†5.60
Flaxseed,	22.60	33.70	7.10
Linseed meal, O. P.,	32.90	7.90	8.90
Linseed meal, N. P.,	33.20	8.00	9.50
Corn silage,	1.07	0.80	6.00
Alfalfa hay meal,	14.3	2.20	25.33

*Note high per cent. †No hulls.

This table gives you the analysis of the cereals as nature produces them. It also gives you the analysis of the by-product as the chemists find them, and I hope that this table may aid you in becoming educated in regard to the feeds that go to make up the concentrated pure feeds that are on the market.

I am often asked the question, "What is the analysis of the adulterants that are mixed with the feeds that are found on our markets?" I will give you a table of the adulterants that we have found on the markets of Pennsylvania:

Name of Adulterant.	Crude Protein.	Crude Fat.	Crude Fiber.
	Per cent.	Per cent.	Per cent.
Corn cobs, ground,	2.40	0.50	30-33
Oat hulls,	3.00	1.00	29.33
Buckwheat hulls,	4.60	1.10	43.30

By referring to the law, you will find that corn cobs can only be mixed with corn products, such as corn meal, hominy and gluten. In our work for the year, we have not found any corn cobs mixed with gluten. We have found one firm mixing corn cobs with hominy feed and another firm manufactures a feed, using corn on the ear and hominy, but the fiber in this feed has been kept at about 10 per cent. as the law requires, except in two samples, and in these cases your Secretary ordered prosecution. We secured conviction in both cases and the fine of $50.00 and costs were paid, which were covered into the State Treasury.

Oat hulls are a common mixture with feed, but the law says that if used, they must be so stated in the composition, and that the fiber content of said feed shall not exceed more than 9 per cent. with a variation of 10 per cent. of the 9 per cent. which would make 9.90 per cent. We have had some trouble with the manufacturers who are using oat hulls in a mixture, to keep their fiber near the amount stated. They claimed that they had old goods on the market of Pennsylvania, and that we had secured samples of this. They also claimed that they had trouble in mixing their goods to comply with the law. After a few prosecutions were brought, this firm placed on our markets feeds that now comply with the law. One firm indicated that they were going to withdraw their goods from our markets, and this is a matter which they will have to decide for themselves.

The great trouble during the year that we have had to contend with, has been the molasses feeds that were found upon the markets of Pennsylvania. The law prohibits the mixing of weed seeds with any feeds sold in our State. A number of manufacturers of molasses feeds persisted in mixing all kinds of weed seeds in their feeds. Their attention was called to these violations, but they still continued to mix weed seeds with their feeds. The Secretary directed prosecution against the said firms, and we have secured conviction in each case, and we believe that we will be able by constantly looking after the matter to prohibit the mixing of weed seeds with any concentrated commercial feeds sold in our State. We think it is time that some of the Eastern states that are consumers of feeds as we are, would endeavor to have passed a law similar to our own. The Pure Food Law protects the human race, and we as men should protect the animals that cannot say what they will eat, but have to eat what is given them or do without. There should be more education on this subject. Six years ago, there was very little known about the analysis of feeds, in fact, very few knew what protein and fat were, and it was only four years ago that we had written in the law, directing the manufacturer should give the analysis for fiber. The question came up at once, What had fiber to do with the foods? But you are all coming to find out.

I do not wish to criticize any of the educational departments of our State, but I was very sorry to see that at the last Farmers' Week at State college, there was not one person on the program to give any instruction on commercial feeds, and in looking over the list of lecturers at Farmers' Institutes I can only find one who was scheduled to talk on this great subject. I believe the question is important enough to the farmers and dairymen of Pennsylvania to have some one on each section of the Farmers' Institute force that could or

would talk on commercial feeds as they are found in Pennsylvania. You will find a large number of instructors who are able to tell you all about fertilizers and other subjects.

By the last information that was secured in the Department of Agriculture in regard to the amount of fertilizers sold in the State, it was estimated between six and seven millions of dollars worth, and after consulting with men who I believe know, I am safe in saying there are more than thirty millions of dollars worth of concentrated commercial feeding stuffs sold in Pennsylvania during 1910. This will give some idea of the importance of this subject.

I hereby give you a table that gives the names of the county, town or city visited, number of samples taken in each town, number of samples taken in each county and number of towns visited where no samples were taken.

This table shows that there were 1500 samples taken by our Special Agent in 1910. It also shows the number of towns that were visited in which there were no samples taken. The reason that there were no samples taken in these towns, was that the feed on sale had been sampled in other towns near by. We could not visit near all the feed stores in each county, as it would have consumed all the time of the agent, and it would have been impossible to visit all the counties of the Commonwealth. This matter will be referred to under the head of "Our Needs."

TABULATED STATEMENT

Name of County Visited.	Name of Town or City Visited.	Number of samples taken in each town.	Number of samples taken in county.
Indiana,	1. Blairsville,	8	
	2. Saltsburg,	5	
	3. Blacklick,	0	
	4. Homer City,	7	
	5. Indiana,	8	
	6. Ernest,	0	
	7. Clymer,	0	
	8. Creekside,	0	28
Cambria,	1. Patton,	5	
	2. Hastings,	2	
	3. Barnesboro,	3	
	4. Carrolltown,	2	
	5. Ebensburg,	1	
	6. Johnstown,	17	
	7. South Fork,	0	
	8. Gallitzin,	0	
	9. Scalplevel,	0	
	10. Conemaugh,	0	
	11. Cresson,	3	33
Susquehanna,	1. Montrose,	9	
	2. Alford,	1	
	3. New Milford,	7	
	4. Great Bend,	3	
	5. Susquehanna,	10	
	6. Lanesboro,	2	
	7. Oakland,	0	
	8. Hallstead,	0	32

NOTE: No samples were taken in some towns, where indicated, from the fact that the feed found had been sampled.

TABULATED STATEMENT—Continued

Name of County Visited.	Name of Town or City Visited.	Number of samples taken in each town.	Number of samples taken in county.
Bradford,	1. Towanda,	4	
	2. Ulster,	8	
	3. Monroeton,	4	
	4. Towanda, R. F. D. No. 3,	3	
	5. Athens,	3	
	6. Sayre,	4	
	7. Troy,	6	
	8. Alba,	6	
	9. Canton,	3	
	10. South Waverly,	0	
	11. Milan,	0	41
Bedford,	1. Everett,	1	
	2. Bedford,	14	15
Bucks,	1. Quakertown,	2	
	2. Richland Centre,	4	
	3. Doylestown,	9	
	4. Chalfont,	0	
	5. Lansdale,	0	
	6. Colmer,	0	
Tioga,	1. Wellsboro,	16	
	2. Westfield,	7	
	3. Elkland,	3	
	4. Knoxville,	8	
	5. Osceola,	0	
	6. Cownesque,	0	34
Potter,	1. Coudersport,	13	
	2. Ulysses,	0	13
McKean,	1. Port Allegany,	8	
	2. Kane,	9	
	3. Bradford,	16	
	4. Mt. Jewett,	0	
	5. Eldred,	0	
Cameron,	1. Emporium,	10	
	2. Driftwood,	0	10
Elk,	1. Ridgway,	8	
	2. St. Marys,	8	
	3. Johnsonburg,	3	
Warren,	1. Warren,	10	
	2. Youngsville,	3	13
Westmoreland,	1. Derry,	4	
	2. Latrobe,	3	
	3. Greensburg,	16	
	4. Irwin,	8	
	5. Jeannette,	9	
	6. Manor,	0	
	7. Mount Pleasant,	8	
	8. Scottdale,	5	
	9. Belle Vernon,	2	
	10. New Kensington,	4	
	11. Parnassus,	0	
	12. Monessen,	2	61
Fayette,	1. Uniontown,	13	
	2. Connellsville,	0	
	3. Belle Vernon,	1	14

NOTE: No samples were taken in some towns, where indicated, from the fact that the feed found had been sampled.

TABULATED STATEMENT—Continued

Name of County Visited.	Name of Town or City Visited.	Number of samples taken in each town.	Number of samples taken in county.
Allegheny,	1. McKeesport,	5	
	2. Pittsburg,	10	
	3. Wilkinsburg,	8	
	4. Carnegie,	12	
	5. Wilmerding,	5	
	6. Pitcairn,	3	
	7. Braddock,	10	53
Washington,	1. Monongahela,	7	
	2. Charleroi,	6	
	3. Washington,	18	
	4. Canonsburg,	14	
	5. Houston,	0	45
Greene,	1. Waynesburg,	5	5
Armstrong,	1. Apollo,	4	
	2. Vandergrift,	3	
	3. Leechburg,	5	
	4. Kittanning,	14	
	5. Ford City,	1	
	6. Manorville,	2	29
Beaver,	1. New Brighton,	8	
	2. Beaver,	1	
	3. West Bridgewater,	1	
	4. Monaca,	3	
	5. Beaver Falls,	0	13
Lancaster,	1. Lancaster,	23	
	2. Lititz,	9	
	3. Leaman Place,	6	
	4. Manheim,	8	
	5. Kinzer,	5	
	6. Ephrata,	2	
	7. Columbia,	6	
	8. Elizabethtown,	14	
	9. Christiana,	4	
	10. Witmer,	3	
	11. Bird-in-hand,	3	
	12. Paradise,	0	
	13. Gap,	0	
	14. Ronk,	0	
	15. Strasburg,	0	
	16. Mt. Joy,	0	83
York,	1. York,	32	
	2. Hanover,	12	14
Chester,	1. Coateseville,	8	
	2. Parkesburg,	6	
	3. Downingtown,	4	
	4. Mortonville,	2	
	5. Modena,	0	
	6. West Chester,	15	
	7. Kennett Square,	4	
	8. Westgrove,	0	
	9. Phoenixville,	0	39
Mifflin,	1. Lewistown,	10	
	2. McVeytown,	2	
	3. Reedsville,	0	12
Juniata,	1. Port Royal,	2	
	2. Mifflin,	3	5

NOTE: No samples were taken in some towns, where indicated, from the fact that the feed found had been sampled.

TABULATED STATEMENT—Continued

Name of County Visited.	Name of Town or City Visited.	Number of samples taken in each town.	Number of samples taken in county.
Jefferson,	1. Lindsey,	3	
	2. Punxsutawney,	3	
	3. Reynoldsville,	4	
	4. Brookville,	4	14
Lycoming,	1. Williamsport,	19	
	2. Newberry,	5	
	3. Montoursville,	3	
	4. Williamsport,	3	
	5. Muncy,	0	30
Clinton,	1. Lock Haven,	8	
	2. Flemington,	2	
	3. Renovo,	7	
	4. Millhall,	0	17
Centre,	1. Bellefonte,	4	
	2. Philipsburg,	18	22
Adams,	1. Gettysburg,	5	5
Franklin,	1. Waynesboro,	55	
	2. Greencastle,	2	
	3. Chambersburg,	12	
	4. Scotland,	7	
Cumberland,	1. Shippensburg,	8	
	2. Newville,	8	
	3. Carlisle,	10	
	4. Mt. Holly Springs,	8	
	5. Mechanicsburg,	6	40
Dauphin,	1. Harrisburg,	19	
	2. Middletown,	4	
	3. Steelton,	3	26
Lebanon,	1. Lebanon,	13	
	2. Myerstown,	17	
	3. Annville,	0	30
Berks,	1. Reading,	36	
	2. Mt. Penn,	1	
	3. Kutztown,	5	
	4. Fleetwood,	3	
	5. Birdsboro,	0	
	6. Boyertown,	0	
	7. Lyons,	0	
Lehigh,	1. Allentown,	37	
Huntingdon,	1. Huntingdon,	8	
	2. Mapleton,	7	
	3. Mt. Union,	8	
	4. Petersburg,	0	23
Blair,	1. Altoona,	59	
	2. Martinsburg,	14	
	3. Hollidaysburg,	5	
	4. Tyrone,	9	
	5. Juniata,	0	
	6. Bellwood,	0	
	7. Duncansville,	0	87
Clearfield,	1. Munson Station,	8	
	2. Osceola Mills,	3	
	3. Du Bois,	12	
	4. Clearfield,	8	
	5. Wallaceton,	5	
	6. Houtzdale,	0	
	7. Morrisdale,	0	
	8. Winburn,	0	36

NOTE. No samples were taken in some towns, where indicated, from the fact that the feed found had been sampled.

TABULATED STATEMENT—Continued

Name of County Visited.	Name of Town or City Visited.	Number of samples taken in each town.	Number of samples taken in county.
Northumberland,	1. Sunbury,	16	
	2. Shamokin,	5	
	3. Mt. Carmel,	5	
	4. Milton,	19	
	5. Watsontown,	3	48
Union,	1. Lewisburg,	11	
	2. Mifflinburg,	2	13
Snyder,	1. Selinsgrove,	8	8
Montour,	1. Danville,	17	17
Columbia,	1. Bloomsburg,	11	
	2. Catawissa,	8	
	3. Berwick,	5	24
Perry,	1. Marysville,	2	
	2. Duncannon,	5	7
Luzerne,	1. Wilkes-Barre,	35	
	2. Hazleton,	9	
	3. Nanticoke,	8	
	5. Edwardsville,	0	
	6. Kingston,	0	
	7. Luzerne,	0	
	8. Pittston,	0	52
Lackawanna,	1. Scranton,	28	
	2. Dunmore,	0	28
Butler,	1. Butler,	20	
	2. Harmony,	8	
	3. Zelienople,	0	
	4. Evans City,	0	28
Mercer,	1. Mercer,	7	
	2. Greenville,	4	
	3. Sharon,	2	
	4. South Sharon,	3	
	5. Sharpsville,	2	24
Lawrence,	1. New Castle,	8	8
Venango,	1. Oil City,	16	
	2. Franklin,	3	
	3. Emlenton,	4	23
Forest,	1. Tionesta,	8	8
Crawford,	1. Titusville,	8	
	2. Utica,	0	
	3. Cochranton,	0	8
Erie,	1. Corry,	4	
	2. Union City,	10	
	3. Erie,	12	26
Montgomery,	1. Pottstown,	18	
	2. Pottstown,	5	23
Delaware,	1. Chester,	12	12
Philadelphia,	1. Philadelphia,	1	1
Somerset,	1. Windber,	4	
	2. Somerset,	10	
	3. Rockwood,	1	15
	4. Plymouth,	0	

NOTE: No samples were taken in some towns, where indicated, from the fact that the feed found had been sampled

I also hereby submit a table showing the places from which the samples were sent in, under that section of the law which says that any resident of Pennsylvania can forward to the Department a sample of feeding stuffs, enclosing a fee of one dollar for the analysis of the same. The said analysis shall be made within fifteen days upon receipt of sample at the Laboratory. This table will give you some idea of the interest that is taken by the purchasers of feed throughout the Commonwealth:

SPECIAL SAMPLES RECEIVED FOR ANALYSIS DURING THE YEAR 1910

Name of County.	Name of Town.	Number of samples received.	Number of samples received from each county.
Allegheny,	1. Pittsburg,	12	
	2. Allegheny,	1	
	3. Large,	1	
	4. Cheswick,	1	15
Armstrong,	1. Apollo,	1	1
Beaver,	1. New Brighton,	5	5
Bedford,	1. Saxton,	1	1
Berks,	1. Reading,	6	
	2. Kutztown,	4	10
Blair,	1. Altoona,	5	5
Bradford,	1. Rome,	1	
	2. Towanda,	2	
	3. Sayre,	1	4
Bucks,	1. Benjamin,	1	
	2. Pipersville,	1	
	3. Newtown,	3	
	4. Quakertown,	1	6
Butler,	1. Butler,	6	6
Cambria,	1. Johnstown,	4	4
Centre,	1. Center Hall,	1	1
Chester,	1. Coatesville,	2	
	2. Chatham,	1	
	3. Lincoln University,	1	
	4. Malvern,	1	
	5. Parkesburg,	5	
	6. Phoenixville,	1	
	7. West Chester,	1	12
Clearfield,	1. Coalport,	1	
	2. Du Bois,	1	2
Columbia,	1. Berwick,	2	
	2. Fishing Creek,	1	3
Crawford,	1. Meadville,	2	2
Dauphin,	1. Harrisburg,	15	
	2. Highspire,	1	16
Delaware,	1. Camp Ground,	1	
	2. Chester,	3	
	3. Sharon Hill,	1	5

SPECIAL SAMPLES RECEIVED FOR ANALYSIS DURING THE YEAR 1910
—Continued

Name of County.	Name of Town.	Number of samples received.	Number of samples received from each county.
Erie,	1. Erie,	2	
	2. Waterford,	1	3
Franklin,	1. Chambersburg,	4	4
Juniata,	1. Mifflin,	2	
	2. Port Royal,	1	3
Lackawanna,	1. Scranton,	2	2
Lancaster,	1. Christiana,	2	
	2. Columbia,	3	
	3. Drumore,	1	
	4. East End,	1	
	5. Elizabethtown,	4	
	6. Lancaster,	5	
	7. Lititz,	4	
	8. Manheim,	1	
	9. New Providence,	1	
	10. Quarryville,	1	
	11. Vintage,	1	24
Lawrence,	1. New Castle,	1	1
Lebanon,	1. Palmyra,	1	1
Lehigh,	1. Allentown,	1	1
Luzerne,	1. Wilkes-Barre,	6	6
Lycoming,	1. Montoursville,	3	3
Mifflin,	1. Lewistown,	1	1
Monroe,	1. Pocono,	3	3
Montgomery,	1. Collegeville,	1	
	2. Conshohocken,	1	
	3. Lansdale,	2	
	4. Linfield,	1	
	5. Narcissa,	1	
	6. Pottstown,	1	
	7. Schewnkville,	1	8
Northampton,	1. Portland,	1	1
Northumberland,	1. Shamokin,	1	
	2. Sunbury,	4	5
Philadelphia,	1. Philadelphia,	47	47
Potter,	1. Galeton,	1	1
Somerset,	1. Friedens,	1	1
Susquehanna,	1. Herrick Center,	1	
	2. Lanesboro,	1	
	3. Montrose,	3	5
Tioga,	1. Lawrenceville,	2	
	2. Wellsboro,	3	5
Union,	1. Mifflinburg,	2	2
Warren,	1. Sugargrove,	1	1
Washington,	1. Canonsburg,	2	
	2. Elrama,	1	3

SPECIAL SAMPLES RECEIVED FOR ANALYSIS DURING THE YEAR 1910
—Continued

Name of County.	Name of Town.	Number of samples received.	Number of samples received from each county.
Wayne,	1. Hawley,	1	1
Westmoreland,	1. Gibsonton,	2	2
	2. Greensburg,	1	
	3. Manor,	1	
	4. Scottdale,	1	5
York,	1. Brodbecks,	1	
	2. York,	1	2

We find upon the markets of Pennsylvania a number of brands of what is known as calf meal. This meal is compounded to be used in the raising of young calves where there is a scarcity of nature's feed of pure milk. The firms that are manufacturing these goods are making a legitimate feed, and we have failed to find any adulteration in the same, and in reports that have been received from farmers who are using the calf meals, we find that they are favorable to their use.

I here give a table which will give the analysis of three of the leading brands of this meal:

No. 1—

Protein, 27 per cent.
Fat, 5 per cent.
Fiber, 5 per cent.

Composition: Locust bean meal, wheat flour, flaxseed, cottonseed meal, beans, peas and lentils.

No. 2—

Protein, 27 per cent.
Fat, 7 per cent.
Fiber, 5 per cent.

Composition: Oat meal, barley, linseed and cottonseed meal.

No. 3—

Protein, 20 per cent.
Fat, 9 per cent.
Fiber, 3 per cent.

Composition: Oat meal, wheat meal, ground flaxseed and casein.

There is a large amount of chicken feed sold upon the markets of Pennsylvania. A few years ago they were not known in our markets, but at the present time there are thousand of tons sold. They are compounded by reputable manufacturers through the West and

by a number of firms in our own State. These feeds are sold to the consumer at an average of about 2½ cents per pound. In some localities, they run a little less and in other sections, they retail at 3 cents per pound, or they retail at $45 to $60 per ton. I have prepared a table showing what these different ingredients would cost per hundred pounds.

Wheat,	$1.60
Oats,	1.20
Buckwheat,	1.20
Barley,	1.10
Kaffir Corn,	2.00
Millet,	2.10
Corn,	1.50
	$10.70

Dividing this by the seven cereals of which it is composed, we find that they cost on an average of one dollar and fifty cents a hundred or 1½ cents per pound or $30 per ton. The cost of these cereals compared with that of the different scratch grains that we find shows a large profit to the mixer or compounder of the same. Of course, there is one reason that might be given for this difference in cost and that is the profit that must go to the wholesaler also the profit that must go to the jobber. This table consists of the price of the feeds as they are on the market today, but there is one way that the manufacturer of the scratch grains can reduce his mixture and that is by mixing wheat screenings with the same. The larger percentage of the scratch grains that are found upon the market are made up of wheat screenings. I am not condemning the scratch grain as a feed. I am only calling your attention to the difference in price between that which can be mixed by poultryman or farmer and those that are bought in the convenient way from the dealer.

A few years ago, the Department brought prosecution against a number of firms that were manufacturing chicken feed or scratch grain which contained a large percentage of weed seeds, but after our new law went into effect, these have been eliminated to a large extent and the chick feeds that have been found upon the market, with but few exceptions, comply with the Feeding Stuff Law of Pennsylvania.

There are a number of inquiries come to the Department in regard to condimentals that are found upon our markets. These condimentals known as invigorators and blood purifiers, are all sold on the market as feeds for domestic animals. In analyzing a number of these preparations, we find that they contain drugs that can be purchased in any drug store, and if our farmers and dairymen will secure Bulletin 175, pages 147, 148 and 149, they will find the formula or composition of these different condimentals.

I find that the farmers and poultry feeders are always more anxious to get something to feed in a convenient form, which they pay from 100 to 200 per cent. more for, than if they purchased the materials and compound it themselves. This seems to be the natural way of doing things at the present time. We would all sooner have other people to do this work in a wholesale way than to be bothered with it ourselves, but that is a matter for each individual to decide.

The question is often asked, What are distillers' and brewers' grains or by-products. I here give a definition of the same taken from Bulletin No. 175 for the year 1908. This may be of some information to those purchasing feeds, and as it is in a condensed form, it may be of more value than if a full definition were given.

DISTILLERY AND BREWERY BY-PRODUCTS

Distillers' Grains

Analyses on pages 58 and 59, Bulletin No. 175

1908

Distillers' grains are obtained from the cereals in the manufacture of alcohol or whiskey. Usually corn and rye are used, but sometimes, we find that oats, wheat or barley are employed. Briefly, the process is as follows:

The grains are coarsely ground and treated with a malt solution which converts the starch into sugar. Yeast is then added, thus changing the sugar into alcohol, which can be distilled. The residue, consisting chiefly of the protein, germs and hulls of the grains used, is dried and sold as food for cattle. Distillers' dried grains, having all the starch removed, is consequently richer in protein and fat than the grains from which they are derived. These grains are considered valuable and economical food for dairy animals.

Three samples of corn distillers' grains were analyzed, showing an average of 33.69 per cent. of crude protein, 15.24 per cent. of crude fat and 12.17 per cent. of crude fiber. The collection also included one sample of rye distillers' grains which carried less than one-half as much crude protein than was found in corn distillers' grains. The sample also carried nearly three per cent. more crude fiber.

BREWERS' GRAINS

Analyses on pages 58 and 59, Bulletin No. 175

Brewers' grains are obtained from barley in the manufacture of malt liquors. The barley is first placed under conditions favorable to germination, and during this process, the starch is converted into sugar. The sprouts are removed and sold as cattle food while the malted grains are crushed, the sugar is extracted, and the residue is dried and placed upon the market as brewers' dried grains. Distillers' and brewers' grains are fairly disgestible. Four samples were analyzed during 1908 and the average results appear in the following table:

AVERAGE ANALYSES AND RETAIL PRICES

Number of samples,	1	1	6	4
Crude protein,	28.50	22.50	26.34	28.19
Crude fat,	7.27	6.93	7.30	7.43
Crude fiber,	....	....	13.25	14.13
Price, per ton,	$20.00	$23.00	$22.80	$28.25

The number of violations of the Feeding Stuff Law was sixty. We have secured convictions in all of these cases but one, and that case has been appealed to court and will be tried at the March term in the Centre County Court. In the hearings of these cases before the courts, there never has come up a question in the argument of the attorneys for the defense in regard to the constitutionality of the law, and I am led to believe, from the information I received from the attorneys, that our law is a good one and well drawn. The Secretary has been very anxious that our law should not be the means of prosecution, that we should endeavor to educate and inform the manufacturers of concentrated feeds of the meaning of the law and have them comply with the law without bringing more prosecutions than is necessary. The men who are engaged in the sale of feeds throughout Pennsylvania are reputable citizens, engaged in legitimate business, and our experience with them is that they are anxious to handle pure feed and give their customers a fair return for their money.

I would like to call your attention to one instance where a large firm in the West, that for years handled large quantities of mixed feeds, that have placed upon the market feed running very high in protein, high in fat and low in fiber, and they are endeavoring to have their customers buy this feed. They claim that it is more profitable to buy a feed high in protein and fat and low in fiber than to buy the low grade feeds that were formerly on the market.

There is another section of this law that we are pleased to state the manufacturers or importers of feeding stuffs are complying with, and that is, that upon the request of the Department they shall file a registration, giving the analysis and composition of their feeds. We have received 378 registrations for the sale of commercial feeds in Pennsylvania, representing over 1200 brands. Many brands were alike in their composition, such as wheat by-products, distillers' and brewers' by-products and whole grain feeds.

OUR NEEDS

I would like to call your attention to some of our needs for the proper enforcement of this law. The work has so grown and the large number of feed products placed upon our markets has become enormous, and it is impossible for one sampling agent to visit all the feeding stuff stores in Pennsylvania once a year, and we find that a visit should be made at least twice a year to each dealer, if possible. Therefore, we need money to employ one more sampling agent.

We also need in the office one clerk who should be a stenographer and also able to keep books, as each sample that is taken by the agent means just a given amount of work in the office. There must be records kept of these samples, and after they are analyzed, reports of the analysis must be made to the Secretary, to the dealer, to the manufacturer, and one to be kept on file in the office. Thus you will see that 2,000 samples taken, means eight to ten thousand reports to be made of each sample. We also sent out 6500 bulletins and a large number of copies of the law. This all requires clerical work besides the thousands of letters that come to the Department requiring answers. We have grown from a very small beginning to a Bureau of no small means. I have endeavored in the short space

of time that has been allotted to me, to call your attention to some of the most important things connected with our work.

We have here at the meeting samples of the different feeds that we find on the markets of Pennsylvania, as well as samples of the adulterants. You will find a gentleman in charge of the same, and we will be pleased to give you any information that it is in our power to give. The Laboratory is situated on the fifth floor of the Capitol Building, and you will find those in charge delighted to give you any information that they can.

As the General Agent of the Department of Agriculture, I wish to return thanks to Secretary Critchfield for his courtesy and kindness to me and for the confidence that he has reposed in me in carrying out his work.

I also wish to thank the Chief Chemist, Mr. James W. Kellogg, for his kindness and for the able manner in which he has had conducted the laboratory work, and to Mr. John F. St. Clair, the Special Agent, for the care and courteous manner which he has met the dealers throughout the State of Pennsylvania.

Any information that I can give to any member of this Board or any farmer in Pennsylvania, in regard to commercial feeds, I will be delighted to do it. You will find our bulletin covering the work of 1909, one of the best published in the United States.

REPORT OF THE COMMITTEE ON FRUIT AND FRUIT CULTURE

By D. A. KNUPPENBURG, *Chairman*

The year that has so recently slipped out of the arena witnessed a decided march forward in many directions. Looking back over the record and weighing the importance of the different lines of progress, we naturally place at first, the phenomenal development in Agriculture. In the light of past events, I confidently believe that if the year 1911 sees advancement correspondingly as great as that of 1910 there will have been accomplished most marvelous results. In the march of progress those things that most closely concern the home, is the movement to make farm life more attractive and remunerative; the strong interest manifested in civic improvement and the increasing demand that the public schools shall furnish an all-around education that fits our children for active, honorable and self-reliant life. All these and many other forward movements are good, and should enlist the interest and support of every right minded person. The Department of Agriculture is to be congratulated on the changes that have been wrought along this line; but we are only standing on the threshold of what must be accomplished. This is not a result of second-hand information but a matter of absolute personal knowledge.

The people of the State of Pennsylvania have not fully realized the vastness and importance of the wonderful resources before them.

Fruit growing *has* been profitable where near markets, but little has been done toward bringing the people to properly understand the great possibilities within their reach. However, we are prepared to report rapid progress. In proof of this, I wish to call attention to the display of fruits at Horticultural meetings, fairs, institutes, orchard meetings and Grange meetings, which speak in terms too plain to be misunderstood of the advancement of fruit growing in Pennsylvania. It has been fairly demonstrated that a great per cent. of our cheap lands are admirably adapted to the growing of fruits if intelligent and up-to-date methods are used. New acres have been uppermost in the minds of the husbandman. They as yet have scarcely begun to utilize them as they may and *will* in future years. Fruit trees respond beyond the belief of the ordinary person even on what is called worn-out land. The roots penetrate deeper and feed on the fertility stored beyond the reach of the ordinary field crop. Fruit trees put on rapid growth if properly cultivated, fertilized and pruned, and the ever present insect pests held in check by use of improved spray methods, all of which must be followed up intelligently.

The State is doing a great work in bringing the people to understand and practice the new way of growing trees, gathering, packing and marketing fruit. In the model and supervision orchard work now carried on by the State through the Bureau of Zoology, the people are taught to select a proper site; next to prepare the soil for the planting; also how and where to buy stock, how to select varieties best adapted to each locality, how to plant, prune and fertilize; to know dangerous insect pests and how to suppress them. Among the most destructive of these are the San Jose scale, borers, codling moth, curculio, aphides, oyster shell scale, scurfy scale, Putnam scale and the caterpillars. Next comes the fungus diseases, blights, mildews, rusts and rots. Pennsylvania lost one million dollars in 1910 from the ravages of codling moth alone. We see apple, pear, peach, plum, cherry, blackberry, raspberry, gooseberry, strawberry and many other small fruits all in their natural state growing wild. What better proof can we look for as to the adaptability of Pennsylvania to fruit and fruit growing?

What would we think to see a lumbering railroad train with an ancient wood burning engine and a man between each car twisting away at a cast iron break wheel, trying to manage the railroad business of today? This would be just as much in keeping with the times as to see people trying to grow fruit under the system that prevailed fifty years ago. As our young men and women become educated, the farm home is left to the renter, and soon dissolution reigns. The work now in progress by the State of carrying practical information direct to the rural districts, is working out the problem to satisfaction. That is just what is happening on many farms in Pennsylvania.

The bounteous crops of fruit harvested where improved methods have been applied proves beyond a doubt that there still remains in Pennsylvania soil greater wealth than has ever yet been brought out. Thousands of people are encouraged and starting back to occupy the homes once left to the owls. Over 1100 orchards have been treated for insect pests with very marked results; seventy-five per cent. more fruit trees now growing in Pennsylvania than three years previous. Peach comes in profitable bearing the fourth year, apple four to

eight years. Jonathan apple has given three bushels per tree the sixth year.

The fruit crop of Pennsylvania in 1910 was not large, and good prices prevailed; prices of apples last fall ranged from seventy-five cents to one dollar and a quarter per bushel. Peaches from sixty cents to one dollar and a half a basket. The kinds of apples most favored for planting are principally, Northern Spy, Baldwin, Rhode Island Greening, Stayman Winesap, Grime's Golden, York Imeprial, Winter Banana, Stark, Delicious and Jonathan. There is a growing demand for currants and gooseberries and a ready market for small fruits. The market calls for quality. The small things of earth confound the wise, and still there is room.

REPORT ON FORESTS AND FORESTRY

By ROBERT CONKLIN, *Harrisburg, Pa.*

It is the duty of a government to perpetuate itself, and in perpetuating itself there is a further duty to provide for the common welfare of its citizens. With these objects in view, it is wise for a state to see to it that every square foot of soil, the source of wealth, be made to produce its highest revenue. Whenever elements of production are allowed to be wasted, the whole moral fiber of those in connection with the waste is lowered and general dissatisfaction follows. The state in turn suffers from undesirable citizens, loss of industry, income, and at the same time outlay for remedial measures, and a host of economic conditions which can hardly be followed.

Pennsylvania stands high in the list of states, agriculturally, and we are all proud of her record, but as long as it remains true that at least 8,000,000 acres of productive soil are not paying interest on a low investment in them, to say nothing of taxes, and other millions of acres are not producing more than half of what they are capable, we can still bow our heads in shame and think on the matter seriously. When we grasp the enormity of this blot on our records we should be stirred to redoubled efforts to put Pennsylvania where she belongs—not high in the list, but the Keystone of the Arch.

The fact is sometimes overlooked that trees grow on soil and that a wood crop is just as truly a crop as a crop of wheat. It is this fact that I want to recall to your minds today. Trees will grow on soil which is too rocky or too poor to grow any agricultural crop, because only a very small percentage of their make-up is taken from the soil. But it is also true that some trees will grow much more rapidly on moderately good soil than they will on poor soil. They will grow on hillsides too steep to farm, where erosion is taking place or is hard to prevent, along streams, roads and in undesirable corners. They require practically no attention after planting and are all the time growing into value financially and otherwise.

Fifty years ago a farmer in Eastern Pennsylvania planted Norway spruce and European larch along his fence rows. Today the trees

alone are worth almost as much as his farm, and yet they have taken nothing from his annual crops, but rather increased them by reducing evaporation over the fields. At least 4,000,000 acres of cleared farm land in Pennsylvania are fit only for growing trees. Why are they not being planted? Simply because the farmers do not know how, what or when to plant and the returns which may be had from planting. Education must be the keynote of our activity. The present schemes must be intensified, new schemes must be devised, and every means used which will bring economic farm education to every farmer and his family.

There must be more co-operation on the part of the Departments concerned—principally those of Education, Agriculture, and Forestry. School gardens, elementary agriculture, agricultural clubs, Arbor Day, and so on must be gotten into the schools. The school buildings should be the social centers of the communities, and if necessary, the Government must send out social settlement workers. Agriculture and forestry must no longer be left out of county and local teachers' institutes, nor should a consideration of the schools and forestry be left out of farmers' institutes. There are no forestry institutes, but lectures, bulletins, sample plantings and all manner of assistance must be provided for. It behooves every member of our Departments to make each appropriation reach as far as possible, but it is more important that results are obtained from what is done, and then the results themselves must and will speak for increased assistance from the Legislature.

During the past year the activities of the Department of Forestry advanced steadily both along established lines and along new lines. There have been added to the reserve area 17,000 acres, making the total area of reserves now owned by the State 933,582 acres. There are thirty-nine trained foresters and eighty-five rangers in charge of this large area, using every means available to develop it as rapidly as possible and to bring it up to the best economic production.

The importance of protection, especially from fires, is appreciated, but only a small part of a perfect system of protection could be carried out. The survey, opening and marking of boundaries has been continued. Over 1000 miles of roads or trails have been opened this year, making possible the better management of the reserves, and at the same time making them more accessible to the citizens of the State. Old material which would otherwise become fuel for fires or a hindrance to young growth has been gathered and sold at a profit. A number of fire observatory towers have been built and should now be connected with the foresters' headquarters by telephone. Improvement cuttings have been made and some old and decaying trees manufactured into lumber, the object in all cases being to make room for good, sound, young growth yielding a high rate of interest instead of that which is decreasing in value.

About 1¼ millions of forest tree seedlings have been planted this year on the reserves and several hundred thousand more were raised in the nurseries and sold at cost to people of the State. In addition to this, the Department gave assistance to many individuals who wanted to make plantations by making planting plans for them and then superintending the planting itself. In the nurseries of the reserves there are over 5,000,000 seedlings, and the area and production of our nurseries are being increased as rapidly as possible. The Department aims at a planting record of 20,000,000 seedlings a year on State holdings alone, and that is none too few.

The reserves have been open to the public as recreation grounds and during the year 3,556 persons have obtained camping permits, these being required when it becomes necessary to build fires for cooking. The camps have been distributed in 22 different counties. There is absolutely no restriction in the matter of hunting and fishing on the Reserves, except what the game laws impose. The Department wants the people of the State to use the Reserves to their fullest extent, only asking that no needless damage be done to trees and birds, no game laws violated, and no fires built without permission. In addition to those obtaining permits, at least 10,000 persons have used the Reserves for hunting, fishing, or a day's outing not, however, including the thousands of people who frequently visit Mont Alto and Caledonia Parks on the South Mountain Reserve. We have no notion of the number of people who go upon the Reserves annually for berries nor of the value of the crop which they harvest.

The Forest Academy at Mont Alto graduated eight young men in August who are now in the State Forest Service. The work is being strengthened each year and the State can be proud of the young men who have been graduated from there and of the work they are doing on the State Reserves and in the localities where they have been stationed.

Assistance was given in the eastern part of the State toward studying and attacking the Chestnut Tree Blight, and in the western part of the State in an examination of the Ohio watershed with reference to forest conditions, erosion, storage of water, prevention of floods, etc.

We have also been able to give practical assistance to all who have applied with reference to the matter of handling their wooded areas. Our Forest Inspector goes over the ground in each case and formulates a plan suited to the conditions as nearly as can be determined in the time available. It is the aim of the Department to be of as great service to the people of the State as it is possible to be. Our offices are becoming a store-house of information on all lines concerning forests and forest trees, and that information is for the use of the public.

REPORT OF AGRICULTURAL GEOLOGIST

By W. H. STOUT, *Pinegrove, Pa.*

As distinguished between Economic and Agricultural Geology, the former relates to minerals and metals with other useful substances in civilized countries. Agricultural Geology relates to that more important division relating to soils, the producing elements of energy, of muscle, flesh, bone and brain and life itself. The herbs of the soil provide the essential elements to support all animal creation upon the earth, all of which derives nourishment from Mother Earth. Although there exists a liberal library upon Agricultural Geology, it is comparatively small compared with Economic Geology, evidently be-

cause in this country, its importance was not realized earlier as long as unlimited resources of fertile fields could be obtained for the asking and Uncle Sam was rich enough to give us each a farm.

It seems only recently that the fact has dawned upon this nation that agriculture has not kept pace with the natural increase of population and the great influx of immigrants, that an alarm was created by high prices and in some lines a shortage of food products. Occasionally, bulletins are published by the Experiment Stations, but are not extensively read or heeded, and lately the United States Department of Agriculture has entered the field under the title of Soil Survey, in which is engaged a large force of very talented scientists as also some that are not overly qualified.

The voluminous nature of the Soil Survey publications militate against popular interest and the introduction of a new nomenclature, introducing new names for many formations about which there already exists confusion between National and State designation, renders them even less popular. What was known formerly as limestone soil of the great valley south of the Blue Mountain is termed Hagerstown loam, alongside of the Utica and Hudson River shales and slates termed Hagerstown shale loam, Hagerstown stony loam, Hagerstown sandy loam, Porter's black loam, Porter's clay, Porter's sand, Cecil clay, Cecil loam, Sandy loam, Penn clay, Penn loam, Penn sandy loam; then we have Waverly, Marion, Miami, Hanover, Mackinaw and a great variety of local names that apply to practically the same soil characteristics in various and distinct localities. The glacial deposits of the northern section also receive many new names, according to the locality where examined, although the clay, sands, gravel and boulders are practically similar.

Whatever the sources of a soil may be, a proper proportion of sand and clay are the requisites for a good, friable, retentive, easily worked soil. If lacking lime or other substances, these can be supplied and the soil made fertile; now found necessary on many fields that were once productive but depleted by cropping. This State and the country contains a great variety of soils, taking the entire area under cultivation and it is evidently unfair to make this a standard for comparison in crop production with other countries.

England is an illustration. An island of small dimension with a humid, cool climate, tempered by the Gulf stream and a soil largely composed of chalk and lime or volcanic and glacial deposits, with an average yearly rainfall and no such protracted periods of drought to which much of this country is subject, the conditions are quite different. In some parts of Pennsylvania like the counties of Bucks, Berks, in part, Lebanon and Lancaster, the average yield would compare favorably if not fully, with that of any country, while the Mississippi Valley or the states on the Pacific Coast would afford a fairer comparison.

Maine produces more bushels of corn to the acre than any other state, because there are only a few acres, seventeen thousand, in corn; New Hampshire, Vermont, Rhode Island, Massachusetts and Connecticut exceed Iowa by ten bushels an acre, but the Eastern States cultivate only two hundred and thirty-nine thousand acres, while Iowa cultivates nine and a half million acres, or practically four times as much as all the New England states. So, with potatoes; Maine produces two hundred and twenty bushels average to the acre,

while Pennsylvania reports eighty-eight. There are good reasons for the difference, in climatic and soil conditions, with the small area devoted to these crops.

The question suggests itself: If the average for the entire country were up to the highest standard, with thirty bushels of wheat, fifty bushels of corn and two hundred bushels of potatoes, what would the producers receive under such conditions?

In the less productive soils and sections, the Upper Silurian, Devonian, Carboniferous and other systems, where the cultivated ground consists of shale, stones, all clay or sand resting on the upturned edges of the bed rock, at uneven depths below the scanty soil, the yield is reduced at a low average. It makes a material difference whether a soil is a hundred feet in depth or whether one or two feet.

A first class soil, if run over a screen of a fourth inch mesh, would practically all pass through, while that from shale and sand stone consists of material too coarse for plants to obtain the elements of plant food contained, affording a much smaller surface to the feeding of roots, besides the moisture holding power of the finer soil.

Loam, a term frequently used to denote a good soil, chiefly composed of silicious sand, clay and carbonate of lime, with more or less of oxide of iron, magnesia, various salts and decayed vegetable and animal matter. Sand and clay are principal elements forming soil that is friable, easy to work, retentive of moisture and fertility.

Sandstone forms a sand soil; the various shales form clay of various colors; red, yellow, black and intermediate colors; often a very fine clay, hard to work, and frequently if not generally improved by drainage.

There are thousands of acres of such land in this and other Atlantic Coast states, that might be redeemed and made fertile, if the same government aid was afforded agriculture, that is given to irrigation and draining swamp lands in the Southern and Western States. While in the Eastern states, agriculture is taxed and tariffed to supply funds to redeem a great area of unproductive land and bring it under cultivation, they are asked to create competition with themselves and supply the money to do it. A little digression from the strict adherence to the text may be permissible, because all that is mentioned bears upon the subject under consideration.

There is much concern about the future in agriculture in this country and the abandoned farms in many sections, yet the industry seems prosperous in production and no abandoned farms found in sections where the soil is naturally fertile. The rocky cliffs, beechy shale hills and tenacious clays cannot be made to maintain a successful agriculture, except at a cost far above the value of ordinary crops and the owners of such lands are not financially able to specialize. After eking out a precarious existence under adverse conditions, without capital to change to poultry, fruit, dairying, fish, frog or skunk farming, the land must simply be abandoned to avoid distress or starvation in many instances. The encouragement for farmers to produce larger crops does not appear very flattering, when the results are analyzed, when large crops such as were produced last year are worth less than the medium crops of other years.

Having no control over the prices at which general farm crops must be sold in competition with all the world, and the different sections of this country, there is little or no profit except perhaps,

in sections where the soil is fertile and not depleted of fertility by constant and long cropping. The crops produced last year in this country amount to the vast sum of nine billion dollars in value, yet dividing it among the six million farms in the country the average share of each is fifteen hundred dollars. In this State the farmers spend about eight million dollars a year for commercial fertilizer, how much more for lime and manure, there are no records, but the money spent for these articles is a large aggregate.

Things that farmers must purchase, taxes, labor, fertilizers, railroad fares, freight and express rates are not reduced, while farm crops are worth eight and one-half per cent. less than one year since; the decline amounting to two hundred and thirty-six million dollars. There is nothing to encourage agriculture, except the plaudits of transportation lines and consumers; these spur the farmer on to renewed and more strenuous efforts, for the coming year. The report was current recently that the German Government proposed to levy an almost prohibitive export duty on potash, so much needed in our agriculture, that it seemed advisable to annex that country to this, to secure cheap fertilizer. Since the reports were first circulated, the German *Kali* importers explain the situation in recent "ads" in agricultural publications, indicating that the tax will be from fifteen to sixty-five cents per ton.

Farm practices in the treatment of the sands and clays are not always scientific, and farmers are severely criticised, especially by some people who do their farming in cozy offices on rosewood and mahogany desks, from the theories advanced by impractical students, with limited environments and close at hand observations, and from these formulate a theory, that does not meet general conditions. Farmers are also criticised for soil exhaustion and small crop yields, while the fact is that few farmers wilfully deplete soils, except as the products are needed to meet necessary expenses and to support themselves. Undoubtedly, many farms are producing less than fifty years ago, because, grain, hay and livestock were sold for needed funds. Throughout Eastern Pennsylvania, there was scarcely a stream available in farming communities, that was not employed in grinding grain for export and city uses as breadstuffs, besides numerous distilleries turning corn and rye into an abomination before the Lord, in the form of whiskey, thus destroying one of the most important National resources to provide food and drink for the hungry and thirsty, at home and foreign countries.

After all the years of tillage, the sands and much of the clay remain, although somewhat diminished. Transported soils by water or through glacial agencies contain a variety of sand and clay mingled together from various formations, while soils derived from the underlying formations are the same as the rock from which derived and, in many places where the stratification is vertical or steep dip, there is little uniformity, but a considerable difference in short distances. Our honored Executive, Governor Stuart, in his late message to the Legislature, writes thus: "The farms must be saved from exhaustion of the soil." Possibly, the Legislature in its wisdom may devise a method to accomplish the object and solve a problem that has concerned many generations and many nations, without a successful solution until now.

The subject of soil preservation is simply a question of economics, while the principles enunciated by eminent scientists are recog-

nized as established facts; to carry them out, however, under prevailing conditions, is another problem. When the average farm products realize the producer thirty-five cents on the dollar, it becomes a question of dollars and cents. While it is true that the application of potash, phosphorus, nitrogen, lime, manure, turning down green crops and intense cultivation does maintain fertility, the question of cost and the capital necessary to conduct operations and await results enter into the problem which the average farmer does not possess.

The problem of soil preservation is one that has concerned nations for ages and is therefore not new. All nations in history had the same experience; their rise and fall, a prosperous and declining agriculture, extravagance and corruption in government, waging wars of conquest with vast armies that wasted all the wealth that agriculture could produce, are now in a condition of ignorance and bigotry. Some of the most renowned, once famous, prosperous and wealthy sections are today the homes of poverty and distress, remembered only in history, poetry and tradition.

Agriculture in Public Schools

MR. BLYHOLDER: Too much turkey at one meal won't do, so I want to inject another subject that is not on the program. We have discussed for many years the subject of introducing agriculture in our public schools. It is a live question and the great trouble has always been that it has been said that we do not have books suitable to introduce in our public schools.

Now, the reason that I raise this point is that I want to call your attention to the book that I believe is the very thing to supply that want. We have all been handling it for a number of years and never thought of putting in the public schools, and that book is to take the place of the advanced readers in our public schools, and very naturally it does not only teach agriculture but it will teach the children business along with agriculture and I believe if we were to introduce in our public schools the proceedings of this body we would have a reader in that school that could not be equalled by anything. (Applause) Now, I refer you particularly to the proceedings of the Spring meeting. I do not know but what the Winter meeting's proceedings would do as well; but I think the Winter meeting has more business in it and is more of a business session than the Spring session. Take the proceedings of the meeting last May at Butler. I want you to examine that because I want to call the attention of the Legislative Committee to that fact, and I want you to examine that and then be ready to say to us whether you think this committee ought to put this proposition in proper shape and form to be put in your public schools as a reader.

The first thing the teacher would do would be to explain that this book is the proceedings of the State Board of Agriculture. The boy would say, what is this State Board of Agriculture. Well now, there is an opening for the lesson, for the teacher to explain that. Then we open up the books and we see how the Board conducts its business and the matters that are brought before it and discussed and it teaches the boy and girl to do business and how to conduct public meetings and it teaches the scientific truths of agriculture up to the

very last day, because we have in our meetings those who are able to furnish us right up to the very latest, the scientific truths. Now I want to put this question before this body to think of, whether we have not got the very book we have been asking and looking for this long time. I believe with the research that I have made and the study I have made that this is the very book that ought to be put in the public schools. I think it would supply the want in teaching business, the conduct of public meetings and teaching agriculture in a way that we cannot get it in any other way. I raise this question because we have been discussing the subject up to this time and I would like to hear from some other persons because I think it is time we ought to act in this matter and because we appreciate that boys and girls are worth more than all the products and all the crops we can raise and we ought to raise them and prepare them to take our places and be more successful in retaining the productiveness of the soil and raising products than we are because of the knowledge they would get and the facts being taught in this way would instill a taste and inclination to stay on the farm instead of leaving it. I say we would teach all that as we go along in the work. I would like to hear from somebody else.

ADDRESS OF GOVERNOR TENER

Mr. Chairman, and Gentlemen of the Board, I hardly know what is expected of me at this time. You are probably in the midst of your business and interesting discussions and I do not want to inject my presence here especially or in any way that may distract from that and from your duties and the business of the moment. I do not know whether you want me to attempt to make a speech or extend felicitations or welcome you to the city and extend to you the keys of the government, but I am willing to do most anything, Mr. Chairman.

However, while I am on my feet and realizing that you do not expect from me any extended remarks, and neither is it my thought or my purpose to interfere with the regular business of this society today, I am glad, indeed, and I am not unmindful of the honor that is mine at this moment in being invited to come down and to meet with you here and to look each of you in the face.

I believe that we here in Pennsylvania enjoy an unenviable position and record and that we do not put our best foot front in those things and in those enterprises and industries in which we live. Other states lay their greatest claim to fame perhaps in the things that nature has very bountifully endowed them with. They claim for their state, perhaps, that it is the greatest state or best state because of the granduer of the mountains or running streams or its climate; but here in Pennsylvania our greatest claim to fame is the accomplishment of our people; what our people do; the achievements of our people and the splendid citizenship that we have here. (Applause)

I am coming down to material things and what this State has accomplished. It is admitted, of course, that Pennsylvania is the

greatest state in mining and in iron and steel industries; but we do not hear so much about Pennsylvania as an agricultural state and yet each of you, I am sure, know that in Pennsylvania our crops perhaps average better than the average of the United States and that our fruit, our apples, perhaps, are of a quality superior to those of any other place in the United States, but this is not known generally, nationally or to the world.

You are here to consider, I presume, how you can better exploit and better apply what is known to science today for the enlightenment and betterment of the farmers in our whole community, and I hope that the outcome of this meeting will bring something that will be educational for the farmers throughout the State and that they may through the radiance of your good work here enjoy the knowledge that you obtain here today.

I want to thank you especially and again for the privilege which is mine and which I do enjoy. While I am neither a farmer or agriculturist at this time, I was born on a farm and my greatest delight, as I believe everybody's is who has red blood in their veins, is to get out in the open and get down close to Nature. It is especially pleasant at this time to be a farmer, because if he is an intelligent farmer, applies the scientific methods at your hands today, has the qualifications of mind and the knowledge of the treatment of your orchards and all that sort of thing and able to have the modern conveniences, you live in the midst of the same modern improvements and have them just as close at hand as the people who live in the city, and besides have the great advantages of the open country life.

I want to also say that whatever little influence my office posesses, where it can be of use to the betterment or to the furtherance of the objects and principles of this society and this association, it is at your command. (Applause)

PRODUCTION AND CARE OF BARNYARD MANURE

By R. C. E. WALLACE, *Ohio Experiment Station, Wooster, O.*

Barnyard manure is essentially a by-product of the farm. By many it seems to be considered a waste product to be disposed of with the least possible care and the greatest possible dispatch.

In the past farmers, in general, have not understood the real value of manure as a fertilizer and have innocently been losing hundreds of thousands of dollars every year because of the indifferent methods employed in caring for this important product. Fortunately, through the medium of our experiment stations and agricultural colleges, we are now beginning to comprehend the importance of manure in maintaining and building up the fertility of our soils.

Just what value manure may have as determined by its composition is difficult to say because of the wide variation in composition of the substance in question. These variations add to the difficulty in discussing the valuation, application and other points in connection

with manure, and in order to assist in an intelligent study of the subject it will be well to consider briefly a few of the influencing factors.

Different kinds of animals: Each species of domestic animal produces a manure of different quality and different physical properties. Manure from cattle and swine contains a relatively high percentage of water, does not ferment or heat rapidly, and hence is classed as a cold manure. Horse and sheep manure contain considerably less moisture than that of cattle and swine, it ferments easily and is classed as a hot or quick manure. In composition the manure from horses and swine is somewhat richer in nitrogenous materials than is that from cattle, while sheep manure usually contains a higher percentage of both nitrogen and potash than do any of the others.

Effect of the ration: The total value of the manure produced by a given number of animals is largely dependent on the quantity and quality of the food consumed. From 50 to 90 per cent. of the fertilizing elements in the food is found in the excrement of the animals, depending on their age and use, hence the composition of the food determines in large measure the composition of the manure. Foods rich in nitrogen and mineral matter will produce manure rich in the same constituents, while foods poor in fertilizing elements will produce manure of corresponding poor quality. For example—animals receiving a ration consisting only of roots, straw, timothy hay and corn stover will produce manure of relatively low quality, whereas such materials as clover and alfalfa hay, cotton seed meal, oil meal, bran, corn and oats chop, etc., would produce manure of much higher value.

The kind and amount of material used for bedding also influence the composition of the manure. It is probable that straw is the material most universally used as bedding material and it answers the purpose very well. It is cheap and abundant, and while it is low in the elements of fertility it is probably one of the most desirable materials to use for this purpose.

Care of manure: After having produced the manure the next thing is to properly care for it; and the first essential in this direction is to provide a water tight floor in our stalls, and covered manure sheds.

A few years ago the Ohio Station conducted some experiments in the production of manure, by feeding two lots of steers; one lot being kept in box stalls with cement floor and the other lot kept in similar stalls having only an ordinary earth floor; the object being to compare the value of the manure produced on the different floors. With the exception of the two kinds of floors all the conditions were identical. The steers were fed for a period of six months when it was found that the total value of the manure produced per thousand pound steer on the cement floor was worth $2.25 more than was the manure from a similar steer fed on the earth floor. The experiment showed further that there was an actual loss of six pounds of manure per head per day on the earth floor as compared with that collected from the cement floor. This amounted to half a ton per steer, or fifteen tons for the thirty steers for the six months of the test. Taking the average analysis of the liquid excrement from this sort of animal and figuring this on the basis of fifteen cents per pound for nitrogen and six cents per pound for potash, we find that we have lost over sixty-five dollars worth of fertilizer; and a better fertilizer,

too, than would be contained in three tons of commercial fertilizer which it would take at the average price per ton to represent an equivalent value.

A Member: Might we ask how often the stable was cleaned?

MR. WALLACE: About once a month.

MR. HUTCHISON: Were the animals allowed to be out in the open or kept continually in the stable?

MR. WALLACE: They were kept in the stalls and allowed to run loose.

Probably the most common practice of handling manure when it is removed from the stable is to pile it in an open barnyard. Here it is allowed to remain all winter long exposed to the leaching effects of rain and melting snow, and by the time it is applied to the fields in the spring about one-third of the nitrogen, phosphorus and potassium originally present, has been lost. This is not mere conjecture. It has been proven by carefully conducted experiments that fully one-third of all the fertilizing elements present in manure is lost when the manure is exposed for a period of three months in an open yard, due to the agencies of fermentation and leaching.

The practice of drawing manure directly from the stable to the field is probably the best method we can use in disposing of the manure crop. Where this custom is followed but one handling is necessary and the possibility of the losses occurring in open yard storage is entirely avoided. This method of caring for manure is, in fact, coming into somewhat general use, but it is not as general as it should be, nor as it will be when farmers come to appreciate fully the value of the practice. In cases where it is desired to remove the manure from the stable once or twice a day, and where our livestock equipment is not sufficiently extensive to produce a spreader load within this period, the manure shed becomes a necessary adjunct. This need not be an expensive structure but it should in any case be provided with a cement floor. Here the manure may be stored until a sufficient quantity has accumulated to justify its removal to the field; and by having the manure spread evenly over the floor of the shed and keeping it well packed by allowing the animals to run over it, no very serious losses are likely to occur.

So far we have been discussing the care of manure in its natural state only. We learn from a large number of chemical analyses, however, that manure in itself is not a well balanced fertilizer for our ordinary agricultural plants; that it is relatively high in nitrogen and potassium and correspondingly low in phosphorus. Experiments have been conducted by the experiment stations of Ohio, Pennsylvania, Illinois and other states which demonstrate pretty conclusively that the same element, phosphorus, is the one in which most of our soils is deficient. With these facts before us, this question naturally presents itself—"Why can we not, by taking proper care of our manure, retain practically all of the expensive elements, nitrogen and potassium, and by the artificial addition of some phosphatic material, thus supplying the lacking element, phosphorus, thereby convert our manure into a well balanced and more efficient fertilizer?" This question we have endeavored to answer at the Ohio station by an experiment which has now been in progress fourteen years. The answer has been that such a practice can be followed with very decided profit.

In the experiment referred to we have compared manure taken from the open yard with that removed directly from the stall to the field, each in its natural state and also re-enforced with a carrier of phosphorus. As re-enforcing materials we have used the ordinary acid phosphate and raw rock phosphate, both of which have proven to be equally effective; a very slight advantage appearing in favor of the acid phosphate.

PERMANENT PASTURES AND MEADOWS

By W. D. ZINN, *Phillippi, W. Va.*

Ladies and Gentlemen: I think the Chairman said Professor when introducing me. I do not know whether to respond to that or not. I am a farmer, not a professor.

Friends, I am very glad to meet so many of the up-to-date farmers of Pennsylvania. I am sure you are all up-to-date farmers. They are the ones that attend the State meetings. As I look into your faces and see the interested expressions I appreciate being with you. That reminds me of a story they tell on a local preacher in my community. He always introduced his remarks like this: "My friends, I am glad to be here this morning, and I am very glad to see so many of you here." Finally he was invited to preach in the penitentiary and he began his remarks in the usual way: "My friends, I am glad to be here, and I am very glad to see so many of you here."

I am to talk a little while about Permanent Pastures. I come from an agricultural state, if you will permit me to call it such. You may think it a mountain state, a state of mountains and hills. We have them there. We do not have very much level land, and yet there are some places where you can find as many as five acres of level land unbroken by mountain or hill.

Only recently I attended a Stockmen's meeting in my own state, a unique affair. A gentleman who had been shipping cattle for about twenty years or more, shipping export cattle, gave a dinner. He had selected a show steer that he had bought, and having purchased forty thousand or more, and we had a real ox roast. I took a census of that meeting and I found those present (80 in number) represented five thousand seven hundred cattle; mostly export cattle. That is, these men there grazed that many cattle. Out of that number of cattle but twelve hundred were grained during the winter; the balance were fattened on the blue grass. I make this explanation that you can understand that we have some blue grass in West Virginia, but not as much as we should have, and we have not taken the care of it we ought. But we like blue grass, friends, because we think it is a pretty easy way to make a living, and we West Virginians don't like to work any more than we can help. They turn the cattle out in the Spring and see that they have water when they want it and that is about all the work many of the farmers there do. I know of farmers keeping one hundred cattle and not paying

out as much as three hundred dollars during the year for labor. I have a neighbor, who was present at this meeting, and he represents six hundred export cattle that he finishes every year; and I asked him: "Do you grain any?" He replied: "No; if I cannot fatten my cattle on blue grass I will go out of the business."

But I am boosting West Virginia. Our pastures are sources of great income. Sometimes when I talk to farmers in other states they say, why land is too high to graze. You cannot afford to pasture one hundred dollar-acre land. Let us see if we cannot. In France today there is a lot of land that rents for $90 an acre for grazing. Now, they must keep some good stock on it. The reason why we cannot afford to pay high prices for grazing land is that we do not put the right kind of stock on it. If we graze on this pasture land the kind of stock that is grazed in France, viz., high priced breeding stock, such as they ship to us and sell at fabulous prices, then we can afford to pay $100 per acre for good grazing land.

Our pastures in West Virginia, as well as in Pennsylvania, have been "running out." They don't produce as good as they did twenty-five to fifty years ago. In the meeting referred to I asked the question: "How many cattle can you carry now and how many did you carry twenty years ago? " Some reported that they only kept about one-third as many. There is something wrong. We understand at once why land runs out when farmed year after year. We know that the organic matter and the available plant food is exhausted, the land deficient in lime, and we have come to understand that the same thing happens with the grazing lands. Our grazing lands are deficient lands in organic matter and in lime, they having no available plant food, and we must take the same care of our pasture land as of the farming lands if we want to make them keep up their productivity.

Now it shall be my purpose to discuss the ways and means of doing this. We want to look upon our farms and our pasture fields as animated objects. The fact is they have or should have great deal of life. If you take your horse and work him without feeding for three, four or five days a week he becomes lean and weak, and if you don't begin to feed him he will die. We have been working our pasture lands for years and years and only giving them half rations and it is not any wonder they have become unproductive. Our fields must be fed; they must be clothed and taken care of just like the human body. If we fail to do that they will not give the returns they should. The Jewish law required that the land should have all that it produced every seventh year. I don't know whether those old Jews understood scientific agriculture or not, but they were practicing it. Every seventh year all that the land produced went back to the soil. For what purpose? To feed, clothe and make available the plant food for the next six years. Friends, I think we can improve on the Jewish method if we give the soil something every year. Let some organic matter get into the soil to make plant food available and that land will be productive for years to come.

There is no excuse at all for working out land. If you do not leave your farms better for your children than when you found them you have missed your calling in life. Our lands ought to become better; they must of necessity be more productive if the people are to be fed, because everything that we have comes from the soil, and in the future greater demands will be made upon it, for we are told in fifty years from now we are to have two hundred million

people in the United States and all these people must be fed from the soil, so we want to take better care of it and give the land its share, no matter whether farming land or grazing land. If you are a tenant farmer you can rob your landlord year after year. I think I have had tenants to treat me that way. But if you are a land owner you cannot rob the land year after year without it resenting that kind of treatment. It will simply shut itself up to you and say: "You have not given me a square deal; you have robbed me and I don't propose longer to give you a good crop." From these pasture lands you have been driving the livestock off for years. If it is a dairy farm you have been selling the milk off and in that milk there is a certain amount of plant food, and three elements that are found deficient in soils: nitrogen, potash and phosphorus. Whether we sell beef, mutton or milk we are taking available phosphorus from our lands. So, my friends, it is up to you to return this plant food to the soil in some way. It has been shown that many of our pasture fields have run out because the lime-content is too low. There is an acid condition in the soil and it is necessary if we wish to grow good pastures, to apply lime to the soil.

The question of lime is interesting a great many people at this time. We are just now wakening up to the fact that nearly all of our soils are deficient in lime. Over in my state a few years ago a farmer came to me who had a limestone field of seventy acres, lying all over it was limestone rock. His clover had failed in this field and he wanted to know what was wrong with his ground. I said: "I suspect your land is sour." He replied: "It could not be. There is limestone all over my land. It is actually in the way." I said: "Have you tested the soil for acidity; if not test it." The man got blue litmus paper and applied it to his soil and found a great deal of acidity in it and he applied five hundred pounds of granulated lime to the acre and the next year got a fine crop of clover and has been growing clover ever since. That proved that even these limestone soils are becoming deficient in lime and we have got to apply the lime and there is nothing under the sun that will take its place. I had a letter recently from a farmer who said: "I want to plant twenty acres of corn"—that letter was from this State—"and I am in doubt as to whether to use phosphoric acid or lime on the land. What would you apply?" If that land needs phosphorus there is nothing will take the place of phosphorus, and if it needs lime there is nothing to take the place of lime. Test your soil and supply what it needs. I also told him that the probabilities were that the land needed both the phosphorus and the lime, because most of the soils in our state—and that is largely true in this State—are deficient in phosphorus as well as lime. You have been selling the small grains off the farm and these grains have carried away a great deal of the phosphorus, and possibly the manure has not been saved as carefully as it should have been and you have been losing there and the soils are all deficient in phosphorus and we must supply it.

Going back to the lime question: There are various forms of lime we can use on the pasture fields. Where you have the limestone, as you have it up the valley between here and Hagerstown, all I believe you need to do is to crush that limestone and scatter it over the fields. It is the safest form in which to use lime, because you will not burn up the humus when you apply that ground limestone. There is danger, friends, in using too much caustic lime. That burns up

the humus and you deplete the soil of fertility. It will become a stimulant for the time being, but it will leave the land worse than it was at first. Be careful what kind of lime you use, especially on the pasture fields, because you don't have the chance to treat them as you might other fields, and I recommend the ground limestone for the pasture land. Lime sweetens the soil by the particles coming in contact with the particles of soil, hence it would be a great deal better and the sweetening process more perfect if you could plow that soil and mix the lime in because the contact would be more general. It may not be practical for you to plow up the field and put the lime on top of the land. If not, you can get good results from the lime by simply sowing it over the land whether you plow or not. Sowing it on the sod will correct the acidity to some extent but not as perfectly as if you plowed the land and applied the lime on top.

The other day I was told by a farmer, when I said you can get too much caustic lime. He said: "I have used three hundred to four hundred bushels of caustic lime on land and the land produced good crops for twenty years." I said: "How did you apply that lime?" He said: "We apply in this way: We put it in small piles and let it lie there from two to four weeks and then scatter it over the fields." I said: "You are not applying caustic lime. That is carbonate of lime." When burned lime is applied in this way it air-slacks, and air-slacked lime is carbonate of lime. That is the reason why Pennsylvania farmers have been so successful in years past in using so much lime. They have been using carbonate of lime and did not know it; actually so, because that lime became air-slacked and when taken into the soil was in the form of carbonate of lime and did not burn up the humus. It is dangerous, my friends, to put into the soil anything like three hundred bushels or one hundred bushels of caustic lime.

There may be various causes why our pastures become unproductive. As I have said, they may need lime, plant food and phosphorus. The dry weather may have caused the roots to die and the worms may have killed it. I have had all these things happen to my pasture land until I absolutely had no grass. What are you going to do then? If we could plow and reseed, the problem would be easy, but that is not always practical. I am going to tell you what I did. If it suits you, you can do it; if not, you can reject it. We go on to those fields and we harrow them. If the field is smooth we take a double acting cutaway harrow and that is the best I have tried. We cut it up pretty thoroughly so there is little or no sod left. That ought to be done as early in the Spring as possible, February if the ground is in proper condition for tillage; if not, later on. March will do, and April may do. May I think is too late as a rule. I put the lime on before I start the harrowing, sometimes with the grain drill, sometimes a lime spreader and sometimes with a manure spreader. And, by the way, my friends, there is no place on the farm that I believe you can get more out of the manure per ton, except the meadow than on the pasture land. I have come to this conclusion: that we have been putting the manure on the wrong crop for years. My practice formerly was to manure the corn ground directly ahead of the planting of the corn. I never do that now, unless I have more manure than I need in either of these other places. I can get the most out of manure on the pasture land,

meadow land or on a soil improvement crop. If you are growing rye and you want to turn that rye down to improve the land you can get more out of the manure by applying it to that land so you have a good heavy crop to turn down.

I take the manure spreader and spread manure over this pasture field. Try a small acreage at first. If you have fifty acres, try five or ten acres, cut it off from the balance of the field. I use the woven wire fence for that purpose. Apply the lime and manure if you have it. I have applied commercial fertilizer, but I will speak of that later, and then put on some grass seed. There is little or no life in that soil, no plants there; so you want to sow some seed and this is one very important question for the farmer to consider. Twenty-five years ago, when I was a boy, my father would send me out to sow timothy seed or sow the ground to grass and we never thought of sowing anything but timothy seed, especially for permanent pasture. I sowed about a gallon to the acre and then we waited about two or three years for it to sod up. Now it sods up the next year with weeds if you don't put useful plants there. I think timothy is a very poor plant to sow alone in the pasture. It does not last long; it is a soil robber. It feeds on the surface, still I use a little of it. I sow four pounds each of timothy orchard grass and red top to the acre. I don't know what you think about orchard grass. Some farmers say they would just as soon have broom sedge, but I like any kind of grass that makes the Winter shorter and orchard grass shortens the Winter. It stands late in the Fall and comes early in the Spring. So we sow a little orchard grass. Red top will grow in an acid soil. It will grow in a sweet soil as well. It will also grow in a wet soil. If any of that land ought to be tile drained it will pay to do it. It won't pay to grass wet land. The red top grows in rich land. Of course, all plants do. It will also grow in poor land. It makes the sod thick and for that purpose I like to mix some red top, say four to six pounds. Then I would put in some Kentucky blue grass.

It is the greatest of all grasses in the United States and if you have plenty of lime in your land I am sure you can grow it. I sow from seven to eight pounds of Kentucky blue grass and I would be sure that the seed would grow. A good many farmers do not like to sow it because they say the seed don't grow. I want to tell you what the trouble is in many cases. In Kentucky they gather the seed with a one horse stripper. They drive over the pasture lands in June and strip this seed off and put it in bags holding from eight to ten bushels. The farmers sell this seed often before they get it into the barn. The dealers come out from the city and buy it in the field and haul it to the railroad and ship to some warehouse and there it becomes heated and then we buy it and don't get any blue grass when we sow it. Since I have learned this I have been buying my blue grass seed directly from farmers in Kentucky, those who are responsible and they send me good seed and I have no trouble to get it to grow.

I would not stop with that because we have not put anything in the mixture that will add any plant food to the soil. Nitrogen is the only element of plant food that we can grow into the soil, and this is gotten there by growing some legume. I sow nearly all the clovers. I would sow at least two pounds of white perennial clover, that will stay in the land indefinitely; two pounds at least of red

clover and two pounds of alsike clover. We know that alsike clover will grow in acid soil more than red clover and will stay long. It is a cross between the white and red clover and has some of the characteristics of the white clover, being almost perennial in its habits. You could mix mammoth, but these three would be sufficient. Mix these? No. Sow the clover seed by itself and the grass seed by itself. If you mix them altogether and sow, you will not get an even distribution of seed because some of the seeds are heavier than others and fly out further. Then harrow the seed in. I believe in planting grass seed just as much as planting corn and there is no farmer that goes out and throws his corn on top of the ground. They always plant it and I believe these seeds ought to be planted. A good many farmers in seeding have been losing their crimson clover. They sow it but don't get a plant. Nearly everyone, upon investigation, have sown that seed on top of the ground. It is a large seed and possibly germinates and it does not get enough moisture until it withers and dies. That ought to be harrowed in. And so with most of the seed. We should harrow them over; a brush will do; anything to stir it in; and by all means have the seed-bed as good as you can get it, if you must harrow it over several ways.

There are fields in West Virginia from which the grass has died out and we cannot harrow them. The only thing we can do is sow some seed over them. Some of them ought to be reforested and, in fact, I believe that some fields in Pennsylvania should be left go back to forest or have trees planted on them, locust or something else, because they are not worth taking care of and will never make good pasture lands.

Now these plants will need some fertilization, some available plant food, and before I harrow the land the last time I use some commercial fertilizer, and on the character of the soil, my friends, should depend largely the kind I would use, and by kind I don't mean any brand. I am asked: "What brand of fertilizer do you use?" It does not matter about the brand. There are a great many farmers, it is true, up in West Virginia that buy commercial fertilizers by the smell. If it has a strong odor they say it is the very kind of goods they are looking for. It may be worth five dollars a ton. Again they actually buy for color; if it has a good dark color that is the thing they want. I met one of these fellows coming from market with a load of fertilizer. I asked him what he paid for it. He said he got a confidential price on that and he promised the dealer not to give him away. I am always afraid of these confidential fellows and I began to insist on his telling what he really paid for it. The analysis was this: One per cent. of nitrogen; seven per cent. of phosphorus acid and one per cent. of potash. I figured that it was worth about ten dollars or ten dollars and sixty cents from the commercial value of phosphorus, nitrogen and potash. After I had insisted that he tell me, he said he got it for nineteen dollars a ton and that the dealer had sold it regularly for twenty dollars. I said: "You are the fellow who should not want to tell anybody you paid two prices for the fertilizer." There are a lot of farmers doing that. We are buying even what our land does not need. If this pasture land is heavy clay soil and has a reasonable amount of vegetable matter in it you don't need potash. I don't need it on my fields. I have asked my fields what they need and this is the best test and only correct test when we ask

the land. The chemist cannot tell you. He can analyze the soil and tell you how much phosphorus, nitrogen, humus and lime there is there and a lot of other things, but he cannot tell you how much is available. The farmer must ascertain that himself; and I found I did not need potash and nitrogen on my soil when I asked the land what it needed by checking it and by putting on one plot the fertilizer and on another nothing, and I found my land only needed phosphorus. I did not get any appreciable increase by applying nitrogen and potash on the clay soils. I am not speaking of sandy soils where you may need some potash. In all probability on the clay soils you only need to apply phosphorus; you may need nitrogen. And I would say after you have sown that crop you can tell to the line where you applied the phosphorus. I put on one hundred pounds of nitrate of soda on the grass after it is started up well. That will nourish it until the roots run out and get plant food to grow it. It is one of the best things to put on the grass started on timothy meadows. The land may need nitrogen and I believe in that way by applying at the time of sowing a mixture of potash and nitrate of soda, tankage and fish scrap or something of that kind so that it gradually becomes available.

Another thing we want to remember in applying fertilizer on plowed ground is, that potash and phosphorus become fixed at the point of contact. If you apply on top of the land and don't harrow it afterward, the danger is that it will become fixed at the surface; so you want to stir the soil. I harrow thoroughly to get it down. Fixation takes place within twenty-four hours after application.

I have said nothing about permanent meadows. How many have permanent meadows that you don't plow? I want to see if there are any farmers who have them. Quite a few. I think, my friends, that we ought to have just as few of them as possible. Really, I don't believe very much in permanent meadows, and yet there are farms on which we must leave a certain piece of ground to meadow indefinitely and they must be fed like the pasture field. There is not an acre of ground that pays better on my farm than my meadow lands because they produce heavy crops of clover and timothy hay. We get from twenty to twenty-two dollars a ton for it. Some farmers have meadows they wish to maintain. Those meadows run out for the same causes that the pasture lands run out. They need feed. Some of my neighbors have been following this method: They cut up the meadows immediately after harvest and reseed—and there is no better time to do it if the season is right. The mixture they use is timothy, red top and clover, alsike and red clover. They sow a little commercial fertilizer because they want a good growth and we must get it ready to go into winter. If you have manure you can apply it. The farmers have been flattering themselves that they were giving back to the soil all they took from it, but they were not. They were robbing it every time by pasturing it too closely. This we ought not to do. We have been grazing too closely. When I began the business of farming I began with a mortgage and I went out and bought sheep and turned them into the grass I had left in the Fall. I would have better carried the mortgage longer. You cannot afford to graze your meadows closely. In fact, I don't believe a meadow ought to be grazed. I believe the ideal way of handling a meadow is to take the first crop off and then, unless the other crop is large, let it go back to the soil, covering up the land and making

available plant food and furnishing matter to the soil to grow the crop next year. When we cut the hay and haul it off we should put the manure back or apply commercial fertilizer and feed that meadow. We ought not to expect it to do well unless we feed it regularly. I have a neighbor that top dresses his pasture lands every third year with acid phosphate, two hundred and fifty pounds to the acre, and he has some fine cattle and some fine pasture.

THE PENNSYLVANIA STALLION LAW

By DR. C. J. MARSHALL, *State Veterinarian*

The stallion law has now been in operation for three years and in that time has been able to demonstrate both its strong and weak points. That much good work has been accomplished can readily be shown, and that amending the law would still better the horse breeding industry is a foregone conclusion.

Primarily the law has been of great educational value. Heretofore in many instances farmers bought stallions without considering whether they were registered or not. As long as the seller made a statement to the effect that a horse was pure bred and registered the buyer was satisfied. Advertisements such as "An Imported English Shire Stallion Registered in France and America" (this fact was actually printed on a stallion poster) demonstrates that the owner evidently did not know what pure bred and registry meant. Now, however, they realize that in order to secure a pure bred license they must have an authorized pedigree registry certificate, and they have become far more careful.

The requirement of the law which states that copies of the license certificate shall be posted prominently on the inside and on the door of the stable in which the horse is stood, and that a copy shall be incorporated in all advertisements is a good means of preventing misrepresentation by the stallion owners themselves; because the license certificate differentiates distinctly, in large type, between pure bred and grade. Thus, a prospective breeder immediately on viewing the license certificate can see whether or not the stallion is of pure breeding and registered, or whether he is a grade.

I do not believe there is any business in which there is more trickery than in horse dealing, and for that reason it is necessary for breeders to use an extra amount of caution. Many men who are otherwise honest do not hesitate to deceive even a friend when a horse deal is being negotiated. Fraudulent pedigrees and pedigrees from unauthorized associations were a very common occurrence but now, knowing that they will not be accepted as a means of securing a pure bred license they are less frequently found.

The Bulletins issued by the Department on horse breeding topics have also been a great help to stallion owners, in fact horsemen in general. However, they have no immediate bearing on the subject of this paper.

The stallion law has encouraged breeders of good horses by giving them protection and they have in consequence been buying more pure bred stallions than heretofore. To show the actual increase let us take the number of pure bred horses licensed in 1908 which was 666, then in 1909 there were 823 licensed, an increase of 10 per cent., and in 1910 there were 909 licensed, an increase of 10 per cent., while the grade stallions have also been increasing the percentage of the increase has been markedly less. In 1908 there were 1333 grade licenses issued, in 1909 there were 1427, an increase of less than 7 per cent., and in 1910, 1474 grade stallions were licensed, or an increase of only 3½ per cent.

The ratio of increase has been about three pure bred stallions to every grade. Not only have the pure bred stallions brought into the State increased in numbers since the enactment of the stallion law, but the horses have been of a better type, especially among the draft stallions.

The present stallion law is good so far as it goes, but under its provisions it cannot go far enough. The owner's affidavit is a bad feature, but it is impossible to demand that each stallion owner have a veterinarian examine his horse, as in some counties they have no qualified veterinarian. The only means of being sure that a stallion is up to standard is to have a commission appointed which shall examine all the stallions in the State, similar to the way it is done in New Jersey. This would be an ideal means of having all horses passed upon in a uniform way. As it is, there is too much difference of opinion as to just what constitutes a stallion of the best type. This inspection would also bring to light all valueless grade stallions, which although technically sound, are of such inferior breeding, type and conformation that they are a detriment to the horse breeding industry.

A stallion would not necessarily have to be examined each year he is in the State. This could be modified; perhaps stating that all stallions had been passed by the commission and had attained the age of say 10 years would be exempt from further inspection.

Then, too, instead of issuing merely three forms of license certificate, namely: pure bred, grade and cross bred, it would be better it seems to me, to have some distinction between pure bred stallions at least. There should be a class for pure bred stallions of the highest type, second best and so on. This would give the mare owner a better idea of the worth of a stallion. As the law now stands any horse that is properly registered with an authorized association, can secure a pure bred certificate; this puts a prize winning stallion in the same class as a horse, which (although by the letter of the law is entitled to the best certificate) is inferior as to type and conformation. These kind of licenses, however, could not be issued unless a personal inspection were made by the authorities in charge of the enforcement of the law. If the commission before mentioned were a fact, of course, it could also take care of classifying the various stallions.

The Pennsylvania law is one of the few exceptions, in not having a lien clause in it. Eight states, and one of them is Pennsylvania, have no lien on the colt or mare and colt, for a stallion service fee. A clause of this kind in the law would not only encourage breeders to buy better stallions, knowing that they would be able to collect the fee agreed upon, but also, would be an excellent means of enforc-

ing the law. If a lien clause were incorporated in the stallion law, stating that only such stallion owners as had complied with all the requirements of the law, could avail themselves of the right to collect fees under that law, it would naturally make all stallion owners very desirous to fulfill all the provisions of the law.

Much criticism is made in regard to the fact that there is no specified list of hereditary unsoundness in the law. This fact, however, was gone over in detail by your committee at the meeting two years ago. Since that time Dr. W. L. Williams, of Cornell, read a paper at the annual meeting of the Pennsylvania State Veterinary Medical Association which confirmed in every sense of the word the report made by your committee on this subject and brought out more forcibly the importance of allowing great leeway in the subject of hereditary or transmissible unsoundness or disease. There appears to be no condition in the list of those usually considered as hereditary unsoundness without illustrious exceptions.

After all the subject of type and conformation appears to predominate most prominently in the subject of transmission, and while we would not recommend prospective buyers to purchase stallions that are afflicted with blindness, ringbones, spavins, navicular diseases, cryp torchidism, roaring, heaves or sidebones or breed to such sires or dams; yet where horses develop these conditions during service, the law should deal with them leniently and clients should not be too critical.

REPORT OF THE COMMITTEE ON POULTRY

By W. THEO. WITTMAN, *Chairman*

Never, within the history of the State of Pennsylvania, has there been such a widespread and insistent interest in poultry and poultry keeping as has been manifested within the year just past. Probably this is the result, partly, of the ever continuing, upward trend of the already high prices poultry and poultry products demand; thereby calling attention to and emphasizing the profits probable and possible in poultry keeping; partly, of the aggressive and widespread advertising in all classes of current publications, (from the small country weekly up to the highest priced of the biggest dailies and magazines) of poultry and poultry keeping; partly of the widespread awakening in the cities and towns to the desirability of country living, and the idea of these that by keeping a few chickens the entering wedge of a livelihood in the country would be solved; and, partly, by farmers being today more thoroughly awake than ever to the fact that the biggest money profits are possible in specialty farming as against general farming, and that poultry keeping may be an easy and profitable specialty farming.

The people of Pennsylvania, together with the rest of the country, have spent individually small, but in the aggregate, what must be large sums of money, in buying so-called get-rich-quick "systems" of

poultry keeping within the year just past. They have spent this money not altogether because these systems promised wealth unbelievable, but because they really wished information on poultry-keeping and knew of no other source to get it. If the State of Pennsylvania could or would get out an up-to-date and trustworthy bulletin on poultry keeping and give it some publicity, it is more that likely that over a hundred thousand copies would be applied for within a year.

Poultry keepers have been very slow in taking the initiative in securing legislation for bettering the conditions of the poultry industry. But, there is a change of sentiment now going on and it will be a matter of only a few years when poultry people will not only seek, but demand poultry class legislation. One of the signs of this, is the enormous gain in membership within the last year of our National Poultry Association, the Pennsylvania Division of which has alone added, since last September, over one hundred members at ten dollars each. The avowed purpose of this gathering together of the poultrymen is for the purpose *of doing things and getting things.*

An encouraging sign is securing within the year past large appropriations for the encouragement of poultry keeping from various State legislatures, notably, our sister state of New York; and of the Western state, Missouri.

It is to be hoped that Pennsylvania with its large army of out-and-out poultry people and its vast poultry product, both utility or market, and pure-bred or fancy, will not lag behind the other states, but that poultry will receive its due share of fostering care and encouragement from the State and the State Department of Agriculture. To this end, Pennsylvania should have a Bureau of Poultry Husbandry as a Division of its Department of Agriculture. Should have at State College a poultry plant and equipment worthy of the institution and State, and not as now, a plant and equipment which brings a blush of shame to the face of any well informed poultrymen or one, no successful poultryman would be willing to take, rent free.

Pennsylvania includes within its borders thousands of breeders of pure-bred poultry, a few, at least, with a world wide reputation for the high excellence of their stock. Also, held the last year close to one hundred poultry shows, including some of the best and biggest shows in the country, as at Philadelphia, Pittsburg, Scranton, Williamsport and Allentown. The total paid attendance at these Pennsylvania shows must have been upwards of a quarter of a million. And yet the percentage of pure bred poultry on the farms of Pennsylvania is as yet relatively small. Although our dung-hill, mongrel poultry is utterly out-of-date and worthless; and when found on a farm at once stamps the owner as unprogressive and careless, it is my painful duty to report that I found such poultry, within the year, on the farms of some of the members of this Board.

There has been great activity in this and neighboring states within the last year in prosecuting dealers in "Rots & Spots" in eggs and in formulating the general idea that cold storage eggs were bad eggs. And while Pennsylvania certainly wants the enforcement of the law against rotten eggs, it also wants inspectors with discretion. Cold storage of eggs is the great equalizer of prices; making possible the profitable returns to the producer of summer eggs and saving great loss, and in keeping the price of some, winter eggs, at least within the reach of the working class. It is fair to suppose, that, eliminating

cold storage of eggs would send winter eggs to a dollar a dozen, at this period of high food prices.

Where agitation against rotten eggs and cold storage eggs should begin is with the farmer and producer. These two must be made, if necessary, to quit sending fertile eggs to market. To quit this offensive practice without having laws to that effect would be the easiest—and the more profitable. Let us hope, this Board some day, by resolution, will recommend to the farmers and egg producers of this State that they will quit producing and sending to market fertile eggs, or eggs, that are eventually bound to be, rotten eggs.

REPORT OF COMMITTEE ON FERTILIZERS

By A. T. HOLMAN, *Chairman*

The use of Commercial Fertilizers upon the farms of Pennsylvania is increasing at an enormous rate, more and more each year—eight million dollars worth being used last year in the State. The subject being so broad that it cannot be given justice in a short paper like this. One of the most deplorable facts is that farmers as a rule use fertilizers without knowing the contents thereof.

There are two lame points in the Fertilizer Law that are of much importance. First. The law should compel manufacturers to put but one row of figures on the bags. Second. Farmers and gardeners should be compelled to learn to read the analysis intelligently. It is estimated that not over two per cent. of farmers can read the analysis on the bags intelligently. This gives the manufacturers an opportunity to put two or three rows of glaring figures on the bags so as to confuse the buyer. I have met farmers, when you ask them "Whose make of fertilizer do you use?" will answer, Coon Brand, Wheat and Grass Producer, Harvest King, etc., and never know the name of the manufacturer.

HOME MIXING

Some people seem to think this is the only way to get just what the plants need. It is my opinion that it is a waste of time for the reason that no one can mix fertilizer by hand with the same accuracy that manufacturers can who are equipped with the proper machines to thoroughly mix the different ingredients. Any person who would want only a few tons of a special brand and call the attention of the manufacturers they will thoroughly mix just what you want and at a very slight additional cost. The only home mixing practical on the farm is to buy phosphoric acid or acidulated rock and use on the stable manure. In this way you get a more equally balanced fertilizer from stable manure. However, the value of stable manure depends upon the kind of animals that produced it, and the care taken of the liquid portion which contains more fertilizer than the solids, and it is a deplorable fact that this portion is often left to leak

away from barnyards and but little of the fertilizer elements left for the soil. Yet you see good results where this yard manure is put, but it is largely due to the mulching effect of the manure.

A fertilizer has two values,—its commercial and agricultural value. Its commercial value is determined by the market value of its constituents and the cost of labor required in preparing it for the farmers' use. The agricultural value is the increase in quality and quantity it will produce in the crop to which it is applied. Germany claims to have increased their crop productions sevenfold by the use of fertilizers "commercial."

The use of fertilizers is traveling westward farther and farther each year over our once fertile prairies, which years ago it was claimed would never need any feeding in the shape of commercial fertilizers. In Pennsylvania the use of fertilizers has doubled or nearly so in the last ten years. The sections of the State that have the best soil appear to use more per acre than the sections that have less fertile soil. I have experimented along this line and I find there is a limit as to the amount that can be used to a profit.

FERTILIZER LAW

The Fertilizer Law appears to be doing a great good to the farmers inasmuch as the law compels their goods to come up to a certain standard. It is a noticeable fact that there are less stars in the report which were used to indicate that the goods fell below the standard of guarantee.

THE AGRICULTURAL DEPARTMENT

The Agricultural Department is doing good work in connection with its agents who have gathered eighteen hundred and nine fertilizer samples, of which six hundred and sixty-nine were analyzed. Preference was given to those which have not been recently analyzed. The samples analyzed group themselves as follows: 436 complete fertilizers; 8 dissolve bones furnishing phosphoric acid and nitrogen; 1123 rock and potash fertilizers; 47 acidulated rock and phosphates, furnishing phosphoric acid; 24 ground bones furnishing phosphoric acid and nitrogen and 31 miscellaneous samples which group themselves in substance not properly classified under the foregoing heads.

CONCLUSION

Farmers should post themselves in the judicious use of fertilizers and study the analysis. No study will pay better. The land is the farmer's bank, and when the land is enriched through the judicious use of fertilizers the bank account will be increased by which he makes himself a business man of greater use and influence in the community wherein he resides, and will become an object lesson to his neighbors to the extent that we lead, others follow. He who makes two blades of grass grow where one grew before is a public benefactor.

29—7—1910

REPORT OF COMMITTEE ON WOOL AND TEXTILE FIBERS

By D. S. TAYLOR, *Chairman*

Textile fibers may be divided into animal (silk and wood) and vegetable (cotton, flax, hemp and jute and the like). Vegetable fibers may be further divided into soft fibers including manila, icil and istle. The ease and rapidity with which cotton fiber is transformed into yarn and its adaptability to all forms of woven fibers are responsible for the manner in which it has outstripped all other fibers and for its extensive and increasing use.

Wool, of all textile fibers, is one of the most interesting, as well as the most difficult for the manufacturer to handle. The wide range within which the production of wool is possible together with the desirable qualities it possesses for the manufacture of clothing, have made it a most important factor in the history of civilization. Sheep can be raised in any country where warm clothing is needed, (except in Polar regions), and it is natural that the woolen industry should spring up in primitive communities and among people who are too poor to buy material for their clothing. Therefore, wool growing and manufacturing industry has a place practically in all countries. As a country increases in population, however, the lands must necessarily be utilized for agriculture and the range for sheep is reduced in recent years consequently.

The wool growing industry in Europe and America has not kept pace with that in newer countries. Nearly one-half of the world's present commercial supply of wool is produced in Australia, New Zealand and Argentina. Notwithstanding the fact that the production in the United States is not increasing materially, wool is produced in every state.

Silk. The world's production of animal silk has increased during the last century from 30,000,000 pounds to about 50,000,000 pounds. The leading countries in its production are China, Japan and Italy. The demand for silk has been so much in excess of the supply that ingenious efforts have been made in recent years to discover substitutes, and the manufacture of artificial silk has assumed considerable importance. The founders of this industry in France have sought not so much the formula necessary for the complete combination of chemical elements of animal silk, as to produce an article possessing the principle technical properties of silk—more practically—tenacity, brilliancy, elasticity and aptitude for coloring and bleaching. The approximate annual production of this artificial silk is about 8,000,000 pounds, and the production appears to be equal to the demand.

Flax was among the earliest plants cultivated for fiber, and until the advent of cotton, its fiber was used more extensively than that of any other plant. Prior to that time its cultivation was very general throughout the world. The production of this fiber in the United

States is neglected. The area cultivated for flax seed is considerable. The average annual production of flax seed is about 100,000,000 bushels. Of this the United States produces approximately 25 per cent.

Hemp has been cultivated and extensively used for many centuries. In the United States the quantity produced is small, amounting to about 11,250,000 pounds. This represents a remarkable decline in the hemp growing industry in this country, as the production fifty years ago amounted to 149,000,000 pounds.

American production of cotton in 1908 was 6,501,210,800 pounds. Wool and hair from Alpaca goat and other like animals, 311,138,321 pounds. This does not include Mohair.

Sheep. We place the number of sheep fit for shearing in the United States at 41,999,500 head, a decrease of 293,705 from 1909. This decrease occurs in the estimated number of sheep in Western states, which, in 1909 was credited with 28,125,000, and now have 27,500,000, a falling off of 875,000, due largely to the excessive cold and storms of the winter of 1909-10, in the Rocky Mountain region. The sheep in the Southern group of states are estimated now at 1,915,000 head, a loss of 25,000 from the estimate of 1909. There has been an increase in the Eastern and Middle Western states; the number of sheep of shearing age in this group standing at 12,434,500, a gain of 606,295 from 1909.

The wool season of 1910 has unfortunately presented a marked contrast with the active and buoyant year preceding. It has been an unfavorable twelve month for wool growers. The year opened with probably 40,000,000 pounds, or forty per cent. more wool including that in bond, carried over than was the case at the beginning of 1909. The wool market in January, 1909, was quick, with prices fairly firm, but with a marked hesitation among purchasers to contract for new clips. Prices for wool in Pennsylvania for 1910 was about seven and eight cents lower than in 1909 and but little bought until late in the season. Wool values should increase, for several reasons: First, the wool-using population of the world has of late increased more rapidly than wool production. Second, wool's greatest competitor, cotton, has been in short supply and relatively dearer than wool, especially coarse wool. Third, employment at high wages has been so plentiful that the masses have been in position to buy clothes, and clothes made mostly of wool instead of mostly of cotton and shoddy.

Also, there are over 40,000,000 fewer sheep in the world today than there were fifteen years ago, and over 90,000,000 more people using wool. In the consumption of wool the United States is far and away in advance of either of the other great nations, for although somewhat behind the United Kingdom in the quantity required for her factories, all that is manufactured here is retained here for clothing and other uses of our people, and in addition, vast quantities of woolen fabrics are imported from abroad. A large percentage of the wool consumed in the factories of other countries is manufactured for export and sold for use beyond their borders, giving the United States preeminence as a wool consuming country.

REPORT OF THE COMMITTEE ON DAIRY AND DAIRY PRODUCTS

By M. E. CONARD, *Chairman*

The past ten years have been eventful ones in the dairy business. They have brought about conditions that are very discouraging, in the present state of enlightenment, to the average dairyman.

1. The steady and advancing prices of all kinds of dairy feeds.
2. The scarcity and high cost of labor.
3. The unprecedented demand for beef and veal.
4. Until very recently, the persistent low prices for butter, milk, and the like.

All of which have combined to narrow down the margin of profit to the producers until he has been obliged to live without many of the comforts he richly deserves.

There has been a lack of co-operation amongst the producers of milk and butter, and I venture to say that as a class there is a serious absence of business methods employed. There has been, and is yet, a tendency to look for the remedy only at the selling end of the business. We are too prone to think the fault all lies with the man who buys our product and that he should pay up and share the deficit with us. In fact we feel that of late the producer has not received quite his legitimate share of the cash paid by the consumer, but we must know that the dealers in dairy products are business men and are doing just what we should do to protect our own interest. They are doing business on business principles.

There is no reason why the consuming public should be expected to pay prices sufficient to compensate for our lack of proper comprehension of our responsibility as food producers.

The steady and unprecedented growth of the cities and towns of this great Commonwealth has put such markets within our reach as never existed before, and now it devolves upon us as dairymen to till the soil, select and breed up our herds and to so handle their output as to avail ourselves of these markets. There is an increased demand for raw milk which has resulted in a greatly decreased amount of butter made throughout the eastern part of the state.

It is gratifying to be able to report that there is a growing demand for a better and more thorough knowledge of how to utilize the countless acres at our command so that we may be able to supply this growing demand to our own advantage. The interest manifest at the fourteen dairy schools held during the present winter in almost as many counties proves the prevailing desire for more dairy knowledge that will enable us to cut down the cost of production. Indeed we are inclined to believe that we as dairymen are responsible for some of the causes of the narrow margin of profit so much complained of for the following reasons:

1. The absence of co-operation and business methods on the part of the producer in selling the products, selecting and raising cows for the herd.

2. The purchasing of too much feed at high prices instead of adopting a more intensive system of farming and producing most of the food on the farm.

3. Because we are nearly all keeping a low percentage of cows that are worse than useless, that are eating up the profits earned by the better individuals of the herd. They can easily be detected by means of the scales and the Babcock test, and if removed from the herd the net profit of the herd will be increased.

We do strongly urge that methods be adopted by those in charge to as rapidly as possible put within reach of all dairymen the opportunity of getting the much needed information and training that will enable them to increase the productivity of their herds.

We are glad to say, in the absence of definite statistics, that we believe that the average per head output of the cows of Pennsylvania has been somewhat increased in recent years. Surely there is a decided increase in the interest manifested in individual butter and milk records, by the more enterprising dairymen and stock breeders. We cannot too strongly urge that the dairy be replenished by raising well selected calves from cows that have proven themselves profitable producers, sired by pure bred sires of families showing good and profitable records. Calves so selected are well worth the expenditure of all the cost of raising them well and the lottery of breeding is largely eliminated.

Summoning up conditions as we see them it appears that there is a decidedly increased demand for dairy products without a corresponding advance in prices paid, and if these conditions must continue as they probably will, it becomes necessary that we study more thoroughly the breeding and selection of our herds, their more economical feeding and stabling. The best and most sanitary methods of handling and marketing their products so that we reduce the cost to the minimum, for there is nothing more certain than that Pennsylvania's acres will, in a few years, be taxed to their utmost to feed the people.

In connection with this report I want to read you an extract from a book entitled, "Education and Efficiency," by E. Davenport, Dean of the College of Agriculture and Director of the Agricultural Experiment Station of the University of Illinois. The book is published by D. C. Heath & Son, Boston, Massachusetts. The extract is as follows:

"AN AGRICULTURE PRODUCTIVE.

"It is not enough that Agriculture should be profitable. In its development it must also become in the very near future enormously productive. How pressing this point will shortly become few people are able to realize, so abundantly have the virgin soils of this country produced in the past, so boundless have been their extent, and so small has our population been almost up to the present day. A little careful consideration, however, will speedily show that conditions in this respect are to undergo a fundamental change in the very near future indeed.

"Under good conditions, the human animal can double his numbers every twenty-five years. By the aid of emigration and despite the ravages of four wars, we have maintained this rate of increase in this country since the Revolution and the population of the United States has doubled four times in the last hundred years. If we maintain this rate of increase for another century—and something is wrong if we do not—if we maintain this rate of increase we should have in this country a hundred years from now no less

than twelve hundred million people, a hundred million of whom should live in Illinois. Under these conditions not less than thirty millions should live in the State of Maine—that is, the population of the entire United States at the time of the Civil War would then be crowded into a single one of our smaller states, and that within the present contury.

"For various reasons this ratio of increase cannot much longer be maintained, yet it is the natural rate, and it tends to show us what would come about under normal conditions within a century—and what is a century in the life history of a people?

"Believe me, race suicide if it comes will be due not to a failure of the birth rate: it will be from our sheer neglect to maintain conditions that will insure food for the people. This is the form of race suicide against which we need most to protect ourselves, and it is none too soon to begin. The world has not yet learned how to feed such a population as is just ahead and before the present century is ended the largest single public issue will be that of bread.

"Within the life-time of children born today, scarcity of labor will be a matter of history, and abundance of cheap food will be a tale that is told by the grandfather in his chimney corner dozing in his dotage. We are educating in our schools today a generation of childern to live a life that we ourselves have never seen and that history does not record, and we do well if we soberly calculate what their conditions of life are likely to be and mend our methods accordingly.

"We were three hundred years in getting a population of five millions of people, so slowly do numbers pile up when the base is small, whatever the ratio, but we have increased ninety millions in the last hundred years. With such a base and with modern conditions of life, this country can and will produce men at a rate the world has never seen. We can now produce in this country as much increased population in the next twenty-five years as we produced in the whole four hundred years since its discovery by white men, and we can produce twice as many more in the next twenty-five. In fifty years from now we shall have the population of China in this country, unless something goes wrong, and it is the business of agriculture to learn how to feed them. When it has learned this, it will have learned many a lesson the colleges do not now know how to teach."

ADDRESS OF GENERAL BEAVER

Mr. Chairman and Gentlemen: I am very glad to be with you again. I merely stopped in on my way from one of the other meetings. There is no particular subject for me to speak on that I know of, but I confess that I have been tremenduously wakened up since coming to Harrisburg, particularly in view of the horticultural exhibition over at Johnston's Hall. Well, there is no discounting that exhibition, I tell you. I think it is somewhere about ten years ago that we were bewailing not only the business but the decadence of what little horticulture we had in Pennsylvania, and now you go into that great fruit store in Philadelphia where you can pay a half dollar a pound for hothouse grapes and ten cents a piece for Washington and Oregon apples and you will not see anything that will compare in color or quality or taste—because I had one last night—with what you find over here at the show, and if we give attention to the necessities and demands of Pomology in the way of soil and treatment, we are likely I think to stand at the very head of the apple producing regions of the United States. There is no reason why we could not be, for we produce just as good and better apples than you will find at the big fruit store in Philadelphia that were raised in California or Oregon.

I was talking with Mr. Tyson, one of our great growers, and I asked him whether he sold his apples at wholesale, and he said, no, he did better than that; that he got his price; that he had a market for every bit of his product by sending boxes directly to the con-

sumer; and, of course, that is the thing for the producer to do when he can. But I am very well satisfied that there were Winesaps, Spies and old-fashioned Rambos which appealed to me as much as anything I have seen and if they went on exhibition at that great fruit store in Philadelphia alongside what they consider the choicest products of the apple countries of the United States, that they would stand up with all of them as to quality, appearance and taste and as to the mode of packing. After all, that is the great appeal to the eye. It occurred to me that the Italian's method of spitting on the apple and rubbing with his kerchief was apparent on some of the boxes, but on the whole I think they were pretty fair.

But there must be discrimination. This can be overdone by planting your apple trees in the right soil. The soil specialists tell you now they can put an augur in the ground and pull it out and tell you not only to plant apples but what kind. They say, there is the place for the Baldwin apple and you can see from the exhibition over there that there are soils that give color to the Baldwin, its natural color, its distinctive color; and that there are soils which fail to give that color. I saw apples there that were as distinct in color as it was possible to be and yet both labeled Baldwins. One of my friends gave me a Perry county Baldwin grown on a farm that probably cost him ten dollars an acre and I suppose he would not take one thousand dollars an acre for it now if he has it covered with Baldwin apples and the product is equal to the sample which he gave me last night. Indeed I heard of a gentleman this morning—I could hardly grasp it—who had paid fourteen hundred dollars for an Adams county farm and had refused fifty thousand dollars for it the other day simply because it was covered with apple trees. It was in the apple belt. It was producing and ready to make him—well, at least, probably ten per cent. on what he had held his farm at and four hundred per cent.—more nearly one thousand per cent. on what he had invested. So it is worth while for Pennsylvania to persevere.

We are just on the verge of the revolution in our horticulture product, and particularly with that portion of horticulture which relates to Pomology, and I hope to see the time come when I will have to take back all I ever said about Pennsylvania not being equal to New York in regard to its fruit products. At the time it was said, of course, it was true but it is not true today and I am more and more convinced as we see the results of our experiments and the good work that has been done by the Department of Agriculture and cooperated with the State College in its extension work, I am more and more satisfied that we are on the very verge of a complete revolution and a successful revolution along this line. And it is true that horticulture in its other branches is just as important, and we have the soil that will make it just as successful. We have the best home markets in the world. Our census shows that it is, that we have in Pennsylvania the best home markets in the world. We have more cities of twenty-five thousand inhabitants and upwards than any State in the United States. New York has a number of cities that are larger than the majority of our cities, but we have more cities that are utterly dependent upon the region immediately surrounding them and they give to the regions surrounding these cities splendid home markets. And so we want to specialize not only along the line of Pomology but all along the lines of horticulture. We bring our lettuce—I am eating lettuce at home that probably comes from

Florida or Georgia or the extreme South, probably from some islands that belong to the United States. We can raise that right here in Pennsylvania and right now. A little bit of glass will give to our farmers and, if they choose to do it as they always have been doing it heretofore—leave that work to the wives and daughters, it would give a splendid opportunity to the women to earn their pin money simply by the raising of lettuce under glass, and this is always not only a good marketable vegetable but an extremely wholesome one; so that it is a good thing for the community to meet the requirements of these cities, and much depends upon the immediate outside for the variety in their tables and in the wholesomeness of our food.

Heretofore it has been considered the thing for the farmer to raise the wheat that would produce the largest number of bushels to the acre and that has been considered the point to reach. If I can produce one hundred bushels of wheat to the acre it is better than thirty. That is not so. The millers come now and say no; what we want is the wheat that will produce the most nourishment and that will give the best flour to the consumer. After all the consumer is the ultimate man that we must look out for; and the millers say, We don' want your wheat; it don't produce the most and best flour. We must have the wheat that under modern conditions will give the best to the consumer, and so we discover that some of the wheats that would seem to be the best for the farmer are not the best for the consumer, and therefore we must try to meet the conditions that the consumer imposes upon he market. This point was strikingly and vividly brought to the attention of the Research Department or Investigating Department of our School of Agriculture at State College when they listened very sympathetically to a proposition of the millers of Pennsylvania to establish a Department of Engineering, called Mill Engineering, at State College; that they would erect a mill and that we would carry on a line of experiments there that would tell the farmers of Pennsylvania what wheat would produce the best flour for the consumer and would give the most bread and best bread to the man that ate it. And you can see, of course, without any argument or without any appeal that that is sense. We must rise and advance in the production of all our articles which we combine under the general term of agriculture; we must cater to the consumer, and the better we come to him and the better products we offer to him the greater the demand for our products. Of course, you see in the Ladies' Home Journal and in these high priced advertising periodicals the Golden Flour. You see the products of Minneapolis and all other great flour-producing regions displayed in very extensive and very expensive advertisements. But after all there is no reason if we put the same amount of brains into our wheat products why we should not produce wheat in Pennsylvania that will make just as good flour, just as nourishing, just as beneficial and healthful articles of food as they do anywhere in the world, and so we must go a step further.

We have been going wrong in the production of our wheat. It is not the wheat that will produce the largest number of bushels to the acre, but it is the wheat that will give the largest amount of nourishment to the acre that we want to raise in Pennsylvania and the millers are beginning now to measure the price of wheat by the quality of the flour and, of course, that is the thing they have to do and it has come ultimately upon the farmer to do that thing, to

take to the miller, to our own men who grind the wheat and furnish flour to our people, the wheat that will give the largest amount of nourishment to the man and woman and child who eats it. And we can see from just this little illustration that I have used the varieity of our agriculture and the variety of demand which is being made upon the agriculture now for the highest products, for the largest amount of science that can be injected into it. Because this is largely a question of chemistry after all. When the flour is made, the chemist tells you wha' is in it, what the fundamental elements of it are and how those elements are to be used by the digestive organs of the human body to nourish the blood and send it to the heart and to the extremities on its way of helping man and making him the best animal that God has made. And after all that is just what we have to help to do and he is the man we have got to feed and we must feed him in a way that his body will be the very best for the services of his Commonwealth and his Country and of the best illustrative value to his neighbors for right living; and, of course, the farmers have a good deal to do with that. And so we are not only in co-operation with God in making man as perfect as he can be, but are in co-operation with the Commonwealth and country in making man as productive as he can be, and this, of course, is the ultimatum.

GROWING POTATOES

By T. E. MARTIN, *Syracuse, N. Y.*

Mr. Chairman and Members of the Pennsylvania State Board of Agriculture: There is a difference between having something to say and having to say something. I believe, however, that I am in the last situation this forenoon. I am a farmer and I am going to talk to you from a farmer's standpoint.

I have just a few statistics here on potatoes. There are six states that produce one-half the potatoes of the United States. According to the statistics, there were 328,787,000 bushels of potatoes produced in the United States in the past year, of which New York produced 44,676,000 bushels, an average of 102 bushels an acre; Michigan, 34,424,000 bushels, an average of 104 bushels to the acre; Pennsylvania, 27,896,000, an average of 88 bushels per acre; Maine has an average—I won't read the rest—of 210 bushels to the acre; Wisconsin has an average of 95 bushels to the acre; and Ohio has an average of 82 bushels to the acre. So these are the six states that produced one-half of all the potatoes in the United States, ranking in total production in the order named.

Our farm is located in Monroe county, New York, at a little place called West Rush, 13 miles south of Rochester. We bought this place in 1892. It was a fair farm. We knew that it must be drained. We did not have the means to drain it at that time. There was a $3,000.00 mortgage on the place with 5 per cent. interest. In 1894

we took up drainage and we have expended $2,500.00 and it has paid and paid several times over. I just want to say here that if you have excess water in the soil you cannot achieve the best results in potato growing. Our soil is a gravelly one principally. We have some light land. It is practically loam. We have a little dead sand and perhaps five acres of clay in seven or eight different places on the farm in little patches here and there the largest patch has possibly two acres. This is a brief description of our place. It has an elevation of about 550 feet above sea level.

Plowing is a very important point in bringing up soil. Good plowing is an art. I did not come here to instruct your farmers in plowing, but somehow there are many farmers that don't plow their land properly. We like to plow our furrows on edge, at an angle of about forty-five degrees, so that they stand up, for the reason that where the furrows are placed on edge we can get better mixing of the soil than by the furrows being upside down. Where the furrow is inverted or upside down there is very little mixing of the soil. And here are several points: One of the points is if there is organic matter plowed under and that furrow turn over flat, capillary attraction will be shut off between the sub-soil and the surface soil, and this is of the greatest importance especially if the season comes dry; and also by keeping these furrows on edge at an angle of forty-five degrees in the tillage of the field you can bring the different soil particles in contact with each other better than if the furrows were turned upside down. We have gradually lowered our plowing depth from six to ten inches. We plow ten inches for our work and we like that depth. Here is the surface of the soil. The manure and clover rotting down there will be more plant food in the first two or three inches of the surface soil than in the lower inches of soil. If these furrows are turned up on edge you can bring the different stratas and soil particles into contact with each other in the tillage. Sometimes I think about it in this way: I go to a meeting or come in contact with good people and thereby feel strengthened and improved. Then again I go to some other place and came in contact with immoral people with low ideals and I wish I had stayed at home. And so it is with the soil particles coming into contact, those of the surface with those lower down. There is an action set up by the heat, light and atmosphere and so on and that action is of importance to the unlocking of plant food.

We like Fall plowing. We have a short rotation of crops, 18 acres of each—wheat, clover and potatoes, a three year rotation. We grow late potatoes and we must necessarily get the potatoes planted early in Spring so that we can get them off in time in the Fall to sow the potato ground to wheat and then it is too late many times.

Now, my position on the fertilizer question is this: I would not use an ounce of commercial fertilizer until I had first drained the land, given the soil the thorough preparation it ought to have, made clover grow luxuriantly and judiciously made, saved and applied the home manure supply, and then if I wanted more fertility and could make commercial fertilizers pay I would use it; but I would not use it, until that time.

One of the best means of getting and making fertility available on the farm is through the use of clover. We have practiced for four years past a sort of novel way of restoring our land to its original production. We mixed in 25 per cent. alfalfa with our clover

seed, in this rotation which requires three years to go over the farm. Let this represent fields Nos. 1, 2 and 3. Suppose we start this on field No. 1 in 1910, sowing clover and alfalfa on the wheat ground in the Spring. We mix in the clover seed, one-fourth alfalfa. It requires three years to get once over each field, 1910 for field No. 1, 1911 for field No. 2 and 1912 for field No. 3; and then beginning the second cycle 1913, with these same fields Nos. 1, 2 and 3 we use fifty per cent. alfalfa. 1916-1918—3 years, 75 per cent. alfalfa—1919, all alfalfa. Suppose we have ten acres and we wish to apply one-half bushel per acre, we would mix in the five bushels of seed, two and one-half bushels of alfalfa and two and one-half bushels of medium red clover well mixed; then sow it together. We watch for certain conditions as we like to see the soil dry, and well checked up, taking the afternoon, because the soil is checked up more in the afternoon than in the morning. It is dryer and there are no wet leaves having the dew on them. We sow the seed with a broad-caster. Considerable seed goes into the checkings. These checkings ought not to be too deep. If too deep the seed gets into the ground too deep and will not germinate. The next morning we go on the field with a lever set, 3 section, spike tooth harrow, teeth straight up and down. We can harrow fifteen acres in half a day. We like to harrow the seed into the ground. I believe the clover and alfalfa seed should be covered up just as much as garden seed should, and we consider on our place that this is one of the vital points in getting a good stand of clover.

A Member: Do you sow timothy with the wheat in the Fall?

MR. MARTIN: Yes, sir; two quarts per acre at wheat seeding time.

A Member: Do you disturb the timothy?

MR. MARTIN: Yes; harrowing in the clover and alfalfa seed does dig it out some but if a clover or alfalfa plant takes its place I am delighted.

These alfalfa roots (holding up roots) show what alfalfa is doing on our farm. These roots have been carried around in my grip for several weeks and while they are broken off at about two and a half feet still they show what they have done. They are larger than the red clover roots and go deeper in the soil as this small one shows. It is four and one-half feet long now and has probably gone down into the sub-soil two feet further than its present length, judging by the size of the root where it is broken off. Now such roots will give us some hay. Understand the alfalfa seed is mixed in with the clover and sown in the Spring and harrowed in, and wheat harvested in July and in August the wheat stubble is clipped and next year the first crop of hay is cut. We try to get the hay in the barn by the 25th of June, though sometimes it is the 4th of July; but by the 25th of June we like to get it in because it is better food, more nutrition in it. By early cutting you will not get as large a crop, as much in weight; but the second crop will come on at once and there you will gain. The second crop is cut about the 1st of August and the hay brought in and not left on the soil. The third crop is cut about the middle of September and left on the ground. We prefer to cut it because the next crop comes on and by cutting it you destroy the weeds and it gets back to the soil where it is in shape for plant food material quicker than otherwise.

A Member: Do you use any fertilizer?

MR. MARTIN: We are going to cut out the fertilizer. We have gradually increased to 1900 pounds of 4-8-12 per cent. home mixed fertilizer that costs $32.00 per ton; but we are lowering it down now to 800 pounds per acre on potato ground. We expect the time is coming, and we feel sure the time will soon come when we can cut it out entirely, when we go from clover to alfalfa complete. That is it will require twelve years to complete this cycle, 1907-1918, from twenty-five per cent. alfalfa to one hundred per cent. alfalfa.

In traveling around New York State I come across various brands of fertilizer, and up in the northern part of the State I came across this advertisement. I will just read it: "Analysis, ammonia, 13 per cent.; potash, 36 per cent.; phosphoric acid, 33 per cent." I figured that out. The ammonia would be worth $39.00; potash, $32.40 and the phosphoric acid $29.70 a ton, total for the ton, $101.10, and that fertilizer was offered for $10.00 a ton. Now, that is one illustration of the fertilizer situation. When a person practices home mixing he informs himself; he gradually becomes enlightened on the subject, and he hardly is aware of it at the time, but he gets enthusiastic in studying and figuring it out. I remember my wife used to say to me: "What in the world do you stay up nights for, figuring so on the desk here covering that paper with figures," and so on. And I told her I was figuring out fertilizer analysis and forgot myself. A person will get interested in the problems and soon arrives at a point where no fertilizer agent can fool him. It is not difficult to mix fertilizers. It costs about fifty cents a ton to mix, and a man can mix it as good as any fertilizer company can if you take the pains, the saving will range anywhere from $2.00 to $8.00 a ton and you get better goods and know what you have, avoiding paying freight on a lot of stuff from New York that is of no value to you. For instance, if you wanted potash on your place it would be cheaper to buy it in the form of muriate or sulphate of potash rather than in the form of kainit and similar goods on which you would be paying freight on a lot of useless stuff and getting only a small per cent. of actual plant food. Here is another one that I came across in the State of New York: "Guaranteed analysis, 8 phosphoric acid, 4 potash, and sold for $15.00 a ton. That fertilizer was worth to the farmer $11.80. In that ton were 491 pounds of filler. We don't need a filler. We can put that in at home. What I would recommend for potatoes would be, say, 1500 pounds rock phosphate, 14 per cent., and 500 pounds muriate of potash; and this would make up an analysis of 10½ phosphoric acid and 12½ potash, and would cost somewhere about $20.00. An application of 500 lbs. to 800 lbs. to the acre is a good one. As I said before, I would not invest in fertilizer until I had worked out the other problems first. By all means test out the fertilizer and use it intelligently.

Now, we grow just that one variety, Sir Walter Raleigh. We plant a seed plat each year and select the very best potatoes and soil for it, usually containing two to three acres. The seed for the seed plot is treated with formaldehyde to destroy the scab germs. The number of bushels run from 50 to 75 of ideal shaped potatoes that are carefully selected. They are planted by themselves in the potato field. There are several advantages in that. You can give better attention and spray and fertilize better. About the middle

of September, ten days before the potatoes die down, we go over the seed plat and dig up all the diseased and degenerated hills that have not made the growth they should. Understand this work is done ten days or two weeks before the potatoes die down so we can see what each hill has done. The hills not making the growth they ought we dig up and discard. The dead or dying hills we dig up and take out. We take a wheel barrow, crates and potato fork and one man takes two rows and when he comes to a tuberculosis hill we dig it up and take it out. By that method we take out of the seed plot all the diseased stock. At harvest time these seed potatoes are dug and put in the cellar. During the winter when we have time we go through the seed plat product, sometimes 900 bushels, and select out potatoes of the type we have our ideals set to. First, we want the size; next, the shape. We like a potato with a good seed end and a good stem end. Here is a very good type. It is too wide for the length. Here is one I like, from three-fourths to a pound each; and these are treated with the formaldehyde, keeping the scab down. We have an automatic potato planter. I would not recommend this machine. It is too complicated.

I think one of the things brought to my attention forcibly in potato culture was the result of this planter. Here and there in the field were four successive hills of dwarfish plants not up in height with the rest of the potatoes and I wondered what was the cause. I got my thinking cap on and one day it came to me that the seed that grew those four hills came from degenerated stock. We tested it by taking seed from the poor hills and found out next year that was the cause of the poor yield. The seed plant method that I have described is one way of getting better and blooded seed. Every farmer can get good seed himself. If you have a good variety of potatoes, Irish Cobbler, Green Mountain or Sir Walter Raleigh or any other variety that you have taken good care of I would go into the field and dig out 250 or 500 hills and go to another part of the field where the potatoes made a good growth and yield and dig out say 250, 500 or 1,000 more hills and dig, lay out each individual hill separately. Don't mix them up after you get the hills dug. Go over the hills as they are dug out and select the hills that made the best yield. With these next year start a seed and breeding plat. Our potatoes are planted on a rolled surface to insure a uniform planting depth of three to four inches, three feet apart for the drills and in the drills a seed piece every eleven inches. I don't recommend that close planting. If planted close like that on thin soil in an unfavorable season probably the whole crop would result in small marble-like potatoes.

A Member: Do you say two and one-half feet between rows is too close?

MR. MARTIN: With late potatoes that is pretty close. You tramp down and mutilate many vines with cultivator and sprayer. I would rather plant the rows farther apart and the hills closer in the rows. Then the vines don't interlock with each other and you can get through with less damage from the machines.

In cutting the potato, such a potato as that (indicating it) would be cut in four pieces, again as large as that into eight pieces. We take a common paring knife and cut the seed like that (indicating). The way we plant there are 15840 hills to the acre. I think if we allowed one pound to the hill that would give a yield of 264 bushels to the

acre, and if two pounds to the hill it gives 528 bushels; but planted three feet each way gives something like 4840 hills and a pound per hill you would have 80 2-3 bushels to the acre. You can regulate the size of the potatoes or run of the potatoes quite well. Of course, you don't know what the season is going to be. That makes a difference. But if the potatoes average too large, plant larger seed pieces to the hill or hills closer; but if potatoes do not grow large enough plant farther apart in the hills and less seed, less eyes.

After the potatoes are planted we run over the field with the double row riding cultivator. We like to go over the field three times before the potatoes are up, and, gentlemen, this cultivation, these first three cultivations, are done before the potatoes are up by following the potato row ridges left by the planter. We don't try to get close to the ridges but to break up the middles. The roller has gone over the ground and in planting this row the horse walks here (indicating). On the return the other horse walks in there again. We do want to cut deep at this time of the potato's growth because no potato roots will be torn off. I would not cultivate deep after the potatoes were up 4 to 6 inches high. If you follow out the roots you will find them extending out beyond the middles and more and when we break off the roots we are interfering with the potato root system. I would not go too deep the first time over, a little deeper the second time and still deeper the third time. Just as soon as the potatoes come up so we can see the potato rows we adjust the culivator and run just as close to the row as we can. With the double row cultivator we take every other row or the odd rows the first time over and here we have the team in here and we get astride the first and third rows and the second time over we go astride the even rows, second, fourth and sixth rows, and so on through the whole field. This makes five cultivations, three before the potatoes are up and two after. Then we put the weeder on, and we like to go straight across the potato rows with the weeder the first time. The second time over we go lengthwise. This pulls the plants straight with the row and closer attention can be given after under work. This weeder work we like to do after nine o'clock in the morning, when the atmosphere warms up and it is dry and hot. The potato plant will stand more abuse after it is warmed up than it will when cool in the early morning. It will break off easier when cool. The rest of the cultivation is done with riding cultivator by gradually widening apart the teeth nearest the rows. The cultivation ceases the latter part of July. Ordinarily the field receives about twelve cultivations. You say that is excessive. I know it is a lot of cultivation, but at the same time while cultivating we are preparing the land for the following wheat crop. The crop gets two hand weedings, about the middle of July and middle of August.

For spraying, we use the 5-5-50 formula.

REPORT OF THE APIARIST

By H. C. KLINGER

The year past has not been marked by any unusual features except that of the loss of colonies in wintering. The winter stores of honey in the greater part of the State were mainly honey dew. The cold of the winter being long continued, the bees were unable to take a cleansing flight, became sick with "dysentery" and died. In localities where there was no honey dew or where it was extracted in the fall and the colonies fed on sugar syrup or good honey, the winter loss was only a small per cent. Reports from all over the United States confirm the statement that bees should not be wintered on honey dew or even on a poor quality of honey. The foreign matter in this kind of honey being in excess causes a dysentery when the bees are confined too long without flight. Bees seldom "freeze to death" when sufficient stores of good honey are within reach, and the statement that "bees froze with plenty of honey" is only an evidence that they died from being confined too long on poor winter stores.

The various reports from different parts of the State indicate that the crop of honey was far below the average. This was caused to some extent by droughts and failure of the main honey plants. White clover, which is the source of the best grade of honey, was drought killed in the summer of 1909 and made but a weak stand the following spring. A few reports also were made that in several localities bees were killed by spraying with arsenical poisons. Bees died by the thousands and in one instance an entire apiary was wiped out. It seems that it takes some fruit growers a long time to learn that it is an injury, a double injury, to spray while the trees are in bloom. Certain delicate parts of the flower are injured by the spray when it comes in contact with them when it is open. Spraying at such time prevents perfect pollination and also kills the bees and other insects which Nature intended should assist in the forming of fruit. The best time to spray is before the buds open and from five to seven days after the blossom has dropped.

HONEY PLANTS

The plants upon which the honey producers of the State mostly depend are White Clover, Alsike Clover and Buckwheat. There are lumber regions of the State which yet produce crops of basswood honey, but the denudation of our forests will make that product a rarity in a very few years.

White clover carries first honors as a honey plant both in value as a source and an extra quality of honey. It yields a clear, finely flavored product and when nicely capped makes a gilt-edged article for the market. Alsike clover is coming more into prominence than formerly. Many farmers are discovering that it is profitable to sow

it with the other red clovers. It is surer to "catch" than the red clover, has a tendency to "stick" to the soil longer and makes a better quality of hay than red clover alone. It produces fully as much honey as the white clover and its quality is not to be excelled. If it is grown for hay and for honey it will produce at least two good crops every season. The seeds being much smaller than those of the red clover a smaller quantity of seed is needed. A good mixture to sow for hay is one part of Alsike with three parts of red clover.

In some sections of the State buckwheat is the most important yielder of honey. The quality of buckwheat honey is perhaps not as good as that of the clovers or some of the other honeys. It is darker in color, has a heavier body and a flavor peculiar to itself. It is liked by some consumers and to others it is not so palatable. It usually does not command as high a price in the markets and yet there are some places where it brings as much as the finer grades of honey. Buckwheat does not require a large application of fertilizer nor even a rich soil to be a good producer of grain. It frequently yields forty to fifty bushels per acre and instances are on record of much larger yields. It is a quick crop and always leaves the soil in a mellow condition. Many of the hillsides, too poor for other crops, might be sown profitably to this grain merely as a grain crop. It seldom fails as a honey producer and not infrequently gives immense flows of honey. What farmer raising only a few acres of it would not keep a colony of bees "get and hold" all of his own?

There are numerous other plants which in some parts of the State are abundant enough to produce crops of honey, but in most localities serve only to tide over the supply from one flow to the other. Among these is alfalfa, another clover, which yields enormously in the West, where in many places it is the chief source of honey. This plant, too, will prove valuable to the beekeeper of the East after we have passed the experimental stage of growing it.

Another plant pressing itself into notice is Sweet Clover. This plant was for some time condemned as a weed, and working its way through years of prejudice, has attracted the attention of agriculturists and beekeepers as well. In growth it is similar to Alfalfa, and while it is young closely resembles it in appearance. It blossoms during a long season, producing a finely flavored grade of honey. It is valuable as a forage plant and as a soil enricher and inoculator it has no superior. A report from Lancaster county states that it was sown on a field infested with Canadian thistles in 1906, and allowed to reseed itself until in the summer of 1910 it was an almost impenetrable mass of leguminous matter five to seven feet high. The Canadian thistles were crowded out. It will grow on waste places, the hardest clay, stony dirt banks and the most barren looking soil. Why not sow some of this seed on waste places, crowd out obnoxious weeds, enrich the soil and make the air hum with bees?

BEES AS POLLENATORS

In the economy of Nature the bee does not only serve as a collector of nectar but performs another most important work. In order that fruit may be formed, fertilization of blossoms must take place. This work is done either by insects or the wind. Some blossoms are staminate while others are pistillate. In order that fruit may be produced the pollen must be carried from the one to the other.

Other plants have both pistils and stamens on the same flower. It may seem unnecessary that in this case any cross pollinization should take place. Nature has, however, provided that in order that species may not degenerate, in many cases, the pollen of any given flower does not fertilize the pistil of the same flower. This is due to the fact that pistil and stamen do not coincide in their time of ripening and thus depend on the pollen being brought from other blossoms. The bee is the best pollenator known, ever ready to perform his work for what he gathers by the way. He is the best answer to the fruit grower's problems as to what varieties or how he shall plant in order that perfect pollination may take place.

DISEASES OF BEES

The great importance of this subject will perhaps suffice as an apology or a partial repetition of a former report. Of the reports received during the year, three diseases are mentioned as prevalent: Dysentery, American Foul Brood and European Foul Brood. The first named was previously discussed. It is not infectious and can largely be prevented by the wide-awake beekeeper. The last two mentioned diseases are infectious and destroy colonies by attacking and killing the brood. These diseases are so widespread that they are the cause of alarm. Whole apiaries have been destroyed before the cause was known. It is impossible to keep it out of an apiary when others nearby have apiaries that are diseased. A single drop of honey robbed and carried from a diseased colony will infect a whole apiary. From recent reports to the Division of Apiculture, Washington, D. C., 18 counties in the State have reported cases of American Foul Brood and 29 counties European Foul Brood. Reports from all the counties were not available so that other counties not heard from may also have cases of the disease.

The progressive beekeeper will control and stamp out the disease, but it may be impossible to get all the beekeepers who have infected colonies to treat them promptly and hence it is desirable and necessary that the State pass laws that will provide for inspection of apiaries and give power to Inspectors to compel careless beekeepers to treat diseased colonies. It is the only remedy that is efficient in stamping out the diseases. In a large number of states laws have been passed and the results have been satisfactory.

With proper control of bee diseases and with the proper study and manipulation, this State has large possibilities and opportunities for the beekeeper. While but few localities will support possibly more than seventy-five to one hundred colonies, one can travel for miles without finding a single colony of bees. There are thousands of blossoms everywhere unvisited, and safe to say, tons of honey wasted.

It would be as unwise to advise every one to become beekeepers as it would to follow any other one occupation. There are those who specialize in apiary work and not only make a living but lay up a snug sum besides. To do this requires a certain adaptability, a knowledge of the business, and constant study. However, it is not necessary to specialize in order to succeed. Many farmers could keep a few bees and have their table supplied with honey every day in the year. The two interests are allied. Frequently the farmer is a fruit grower to a greater or less extent and the bees by their daily visits increase his yield of fruit. On the other hand,

he could greatly increase his yield of honey by sowing his waste land to honey bearing plants. Any one within reach of a few acres of honey bearing plants by an investment of a few dollars in a colony of bees can not only make a handsome profit on his investment, but may find an increasing interest and sometimes to the extent that for the time being he will forget all his other troubles.

REPORT OF MINERALOGIST

By BAIRD HALBERSTADT, *Pottsville, Pa.*

While twenty-nine (29) states of the Union are producing coal on a commercial scale and the production of all kinds of coal in the United States exceeds that of any other nation in the world, it should be particularly gratifying to the citizens of Pennsylvania to know that our own Commonwealth not only mines and ships more coal by far than any other state, but that it possesses a larger quantity of high grade coal than any other state. Other states may have greater areas underlaid by Coal Measures, but not one can compare with Pennsylvania when the grade and value of its coal deposits are considered.

The State is made up of sixty-seven (67) counties, and of this number, forty-three (43) are either in whole or in part underlaid by the Coal Measure rocks. Of the forty-three (43) counties so endowed, thirty-two (32) contain coal of the Bituminous and Semi Bituminous variety, the other eleven (11) produce, with the single exception of Lebanon, high grade Anthracite and Semi-Anthracite coals. Beaver and Butler counties, in addition to true bituminous coals, produce a good grade of Cannel coal. The latest statistics available show, that in 1909 the production of coal in Pennsylvania reached the enormous total of 216,429,528 net tons; that its tonnage exceeded that of any nation in the world save Great Britain. In the production of this enormous tonnage, there were empolyed 357,116 persons.

The ten (10) counties from which the production of Anthracite coal was mined were Carbon, Columbia, Dauphin, Lackawanna, Luzerne, Northumberland, Schuylkill, Sullivan, Susquehanna and Wayne.

The counties producing the Bituminous tonnage were Allegheny, Armstrong, Beaver, Bedford, Blair, Bradford, Butler, Cambria, Cameron, Centre, Clarion, Clearfield, Clinton, Elk, Fayette, Greene, Huntingdon, Indiana, Jefferson, Lawrence, Lycoming, McKean, Mercer, Somerset, Tioga, Washington and Westmoreland. Although Lebanon county in the Anthracite district and Crawford, Forest, Potter, Venango and Warren in the Bituminous district are in part underlaid by Coal Measures, no coal is mined from these on a commercial scale, although it is quite likely, that for local and home consumption, coal was mined in all of these counties.

In 1890, when in charge of the collection of the coal statistics of Pennsylvania for the Eleventh Census of the United States, I made

an exhaustive examination into the annual coal tonnage mined from very small operations, for local and home consumption and which was never before accounted for. To the surprise of everyone, this was found to exceed one million tons.

The spot value of the coal product in Pennsylvania in 1908, when 200,448,281 short tons were marketed, was $276,995,152. A comparatively recent computation by Mr. M. R. Campbell of the U. S. Geological Survey (1908) leads him to believe that the original tonnage in the Anthracite coal fields of Pennsylvania was 21,000,000,000 short tons and that of the Bituminous fields 112,574,000,000 short tons. Deducting the coal already mined and that left for support in the mines, Mr. Campbell estimates that at the close of 1908, there remained in the ground nearly 17,000,000,000 short tons of anthracite of which, approximately, one-half could be won.

In the bituminous region, he estimates, after the deduction of tonnages already mined and coal left in the mines for support, the tonnage remaining at the close of 1908 to be 109,000,000,000 net tons.

With an annual tonnage production of both anthracite and bituminous coal equal to that of the year 1908, Mr. Campbell estimates that the Anthracite coal fields of Pennsylvania will be practically exhausted in one hundred (100) years, and the Bituminous fields in six hundred (600) years.

As advances have been and are made toward better and less wasteful methods in many other directions, it is entirely within the bounds of probability to say that methods will be invented soonor or later whereby greater efficiency can be obtained from coal, than through the wasteful, yes, almost criminal, methods now practiced in its utilization. Many plans are now being perfected to check preventable losses. The gas producer is destined to play an important part in checking waste, and it is not wild to predict, that even with present appliances, coal can be distilled and the gas derived from it piped, as is done with natural gas, and compete with this natural product.

How is the installation of plants at mines for producing electricity and conveying its energy to desired points, to be overlooked, when the matter is given serious consideration. Plans, too, to convert the heat units of coal into electrical units of work, without the intervention of the wasteful steam engine, are at present being considered.

Notwithstanding the vast deposits of coal within our State and the daily use of this almost indispensible fuel, it is surprising that even many of those who are mining and shipping it, as well as the mere users of it, should know so little about it and the products which can be derived from it. Generally, it might be said, that to the man or woman of average intelligence, coal is merely a black substance dug from the earth and is burned in stoves to furnish heat for cooking food, for personal comfort and to generate steam in boilers or perhaps some will say, in addition, that from it gas and coke can be made.

It would be hard to conceive of a more beautiful story than that of coal, from its origin; the successive stages of development through which vegetation passes in its progress from the growing plant to anthracite, but when we read that from this black, greasy, smutty mass can be derived medicines, fertilizers, perfumes and exquisite coloring matter, the story becomes almost romantic. Interesting and

instructive as is the story of coal, the limited time at my disposal will not permit me, much as I would like to do, to give it in detail.

Briefly, the successive stages through which the vegetation passed in the formation of anthracite coals are:

Peat
Lignite { Brown / Black }
Bituminous Coal
Semi-Bituminous Coal
Semi-Anthracite Coal
Anthracite Coal

No considerable, if any, commercial deposits of Peat or Lignite are found in Pennsylvania, but no more valuable deposits of Anthracite and Bituminous coals are, perhaps, to be found anywhere, than in our own Commonwealth. The anthracites are used largely for household and industrial purposes. The semi-anthracites furnish an almost ideal domestic fuel, and as such, notwithstanding their extra cost, are in brisk demand throughout the year. Formerly, anthracite coal was extensively used in smelting iron, both in furnaces and cupolas, but of late years coke, because of its superiority has practically supplanted raw coal, in this direction. A new use for anthracite has been found in recent years for the production in connection with crude petroleum, of illuminating gas, and through the use of gas producers, it will sooner or later be extensively used for the production of gas for heating, metallurgical and other purposes. Bituminous coals vary much more in analyses than do the anthracites, for while the component parts are practically the same, their proportions differ widely.

In selecting a coal for specific uses, care must be exercised, because for certain purposes, a more expensive coal would not give as good results as a lower priced product. Certain coals are far better adapted to one purpose than another.

For smithing purposes, a semi-bituminous coal is far superior to a true bituminous coal, for by the use of the latter, because of its high volatile matter percentage, instead of a steady hot fire, the smith has a flaming one, from which much of the heat which should be concentrated escapes into the shop or passes out through the chimney. At several collieries in Clearfield county, mining the Lower Freeport coal bed, an ideal blacksmith's coal can be obtained. For the smithery and steam generation, the semi-bituminous coals are preferable to the bituminous or high volatile coals. Valuable as are the semi-bituminous coals for the smithery and for generating steam, for the manufacture of illuminating gas, they are not adapted and should not be used for this purpose.

In the matter of gas coals, Pennsylvania again shows her superiority, for the coal of the Pittsburg bed in parts of Westmoreland and Allegheny counties has no superior, if an equal, in the United States for the manufacture of illuminating gas. The coal produced from the Pittsburg bed in the Connellsville region makes the standard coke of the United States and, as a coal approaches or recedes from the analysis of this coal, its value as a coking coal is seemingly determined, at least by the trade.

It is interesting to study the changes shown in the analyses of coal from the Pittsburg coal bed, as they show much difference in

the percentages of constituents and especially so in the amount of volatile matter and sulphur contained. Connellsville coal (Pittsburg bed) valuable as it is as a coking coal can not compete with the Youghiogheny-Westmoreland coal for gas purposes, nor could the latter compete with the former for the manufacture of coke. A good grade of gas coal has been mined at Reynoldsville in Jefferson county, and a good coke is made in the vicinity of Punxsutawney, in the same county.

Cokes are manufactured from the coals of the Upper Freeport and Upper Kittanning beds along the main line of the Pennsylvania railroad, between Cresson and Johnstown, as well as a small amount in Huntingdon and Bedford counties. The main source of supply of coke in Pennsylvania is drawn from the Connellsville region, in fact, it may be said that none of this coal is shipped in a raw state but the entire output is manufactured into coke. The Youghiogheny-Westmoreland coal output is largely devoted to the manufacture of gas. This is as it should be, because these coals possess to a very high degree the essential properties requisite for the manufacture of coke and gas.

Coals from certain districts in Pennsylvania have long enjoyed and retain enviable reputations for excellence for specific uses. In fact, so strongly have they become intrenched, that they are now accepted as standards, and when coals from other districts are brought into the markets, these coals are used for comparison. In these days of brisk competition, no district can long maintain its lead, unless its coals possess the essentials requisite.

The question arises: What are the essential characteristics to be sought when purchasing coal for specific purposes.

The specific purposes, it is assumed are:

(1) Steam generation.
(2) Gas manufacture.
(3) Coke manufacture.
(4) Smithing purposes.
(5) Domestic uses.

Steam Coal

For the generation of steam, a coal should possess

(1) A high evaporative power.
(2) It should kindle readily.
(3) It should burn steadily and generate a large body of steam quickly.
(4) It should not clinker, even when subjected to a high heat.
(5) It should be low in ash.
(6) Its percentage of sulphur should not exceed in any case, one per cent., as this is detrimental to both grates and flues.
(7) The contained volatile matter should not exceed the amount requisite for rapid combustion.
(8) It should bear transportation well, so that it will not be seriously reduced to fine coal.

A study of the chemical analyses of Standard steam coal seems to indicate that the best results have been obtained wherein the percentages ranged as follows:

Fixed carbon,	67 to 74 per cent.
Volatile combustible matter,	17 to 22 per cent.
Sulphur,	0.5 to 0.9 per cent.
Ash,	5.0 to 8.0 per cent.

Gas Coal

The requisites of a good coal for the manufacture of illuminating gas are:

(1) That the percentage of volatile matter should exceed 33 per cent.
(2) That the percentage of sulphur should be low and never exceed 0.8 per cent.
(3) A low percentage of ash, not more than 6 per cent.
(4) That it should yield from 75 to 85 candle feet per pound carbonized.
(5) That it should leave, after the extraction of the volatile matter, a bright merchantable coke.
(6) It should be able to bear transportatioon to great distances, without being reduced to slack.

An average of six (6) analyses of coals from the Youghiogheny-Westmoreland gas coal district shows:

Moisture,	1.475
Volatile matter,	37.404
Fixed carbon,	56.024
Sulphur,	0.687
Ash,	4.410
Total,	100.000

Coking Coal

The essentials of a good coking coal are:

(1) It should be pure bituminous coal.
(2) That it should contain a sufficient amount of volatile combustible matter (25 to 30 per cent.) to complete the coking process, with the expenditure of but little, if any, of its fixed carbon.
(3) It should not contain over 0.7 per cent. sulphur.
(4) That its phosphorus content should not exceed 0.12 per cent.
(5) "That the coke produced from the coal should possess sufficient tenacity to sustain, without crumbling, the burden and blast of the furnace, and the cellular structure should be sufficiently open to facilitate its impregnation and solution by the carbonic acid gas in the furnace."

A typical specimen of Connellsville coking coal, upon analysis, showed:

Moisture,	1.260
Volatile matter,	30.107
Fixed carbon,	59.616
Sulphur,	.784
Ash,	8.233
Total,	100.000

A very good grade of coke is made from the coals of the Pottsville series, in both the New River and Pocahontas regions of West Virginia. Analyses of these coals exhibit a higher percentage of fixed carbon and lower percentages of moisture, volatile combustible matter, sulphur and ash than the Connellsville coal. The deficiency in volatile matter in these is detrimental, for the loss of carbon in coking exceeds that of Connellsville by 12 per cent.

Smithing Coal

The requirements for a good smithing coal are that:

(1) It should possess a high heating power and to obtain this, the percentage of fixed carbon should exceed 70 per cent.
(2) It should contain at least 18 per cent. and not more than 22 per cent. volatile matter which is quite sufficient to make it kindle readily and to supply the heat required for coking; it should also possess sufficient coking qualities to form an arch or vault over the forge.
(3) It should not exceed 0.7 per cent. sulphur, since an excess of sulphur prevents good welding.
(4) The percentage of ash should not exceed 6 per cent.
(5) The coke should be bright, clean silvery and have a metallic ring when struck.

With a coal possessing these properties, there is but little waste and, with such, a smith can concentrate the heat upon the iron to be wrought and not have a great blazing fire, with most of the heat escaping through the flue or chimney. When the sulphur exceeds one per cent. a scum or greasy substance forms on the surface of the iron, making a strong weld impossible, and it is otherwise detrimental.

A coal that, among others, was recently tested for blacksmith's use and which gave by far the greatest satisfaction showed upon analysis:

Moisture,	0.780
Volatile matter,	21.680
Fixed carbon,	73.052
Sulphur,	0.688
Ash,	3.800
Total,	100.000

Coal for Domestic Use

For domestic purposes, a coal is desired that burns steadily and will remain ignited at a low temperature until consumed. Such conditions can not be obtained from a true bituminous coal, because it burns too freely and is difficult to control. Again, the high volatile coals, if burned in open grates or stoves, not only throws out soot and dirt but clog the chimneys. Such coals, if high in sulphur, are extremely objectionable, not only on account of the odor thrown off, but because of their tendency to corrode grates and pipes. A coal forming clinkers at a low temperature is undesirable, since such will check the draft by clinging to the grate bars. A coking coal is also undesirable. A dry non-coking coal, high in carbon, with sufficient volatile matter to kindle it quickly; one with but little or no sulphur and a low percentage of ash, affords the most desirable coal for domestic use.

It has been said that the story of the formation of coal is both instructive and interesting and, if that be so, the story of and the methods of obtaining the valuable products to be derived from bituminous coal, through destructive distillation, are equally, if not more so and it reads more like a romance than a cold recital of facts. By destructive distillation is meant the process of heating an organic compound in a closed vessel without access of air and the collection of its products. If bituminous coal be placed in a closed retort and heated, there results from such heating four principal products: gas, water liquid, coal-tar and coke. The gas thus formed is not yet fit for illuminating purposes, but must be purified. In the course of this purification, the gases are passed into a tank nearly filled with water and from them, the ammonia, produced by the combination of hydrogen and nitrogen evolved, is rapidly absorbed. This then is the gas or ammonical liquor which is the principal source from which ammonia is derived. If the gas liquor be heated with lime and passed through diluted sulphuric acid, we obtain crystals of Sulphate of Ammonia, so valuable as a fertilizer.

There are many other products of industrial value associated with ammonia. Much of the gas liquor of gas works is sold to chemical works, yet much is still permitted to waste.

Coal Tar

This product of the destructive distillation of coal was once too, like the gas liquor permitted to go to waste, as there was little or no demand for it. Its value, however, has long since been known. From this ill-smelling, to many, a disgusting and unattractive mass, there are today prepared more than six hundred products. Among these are the almost endless varieties of aniline dyes, paraffin, naptha, benzol, anthracene, pitch, napthaline, carbolic acid, creasote, picric acid, and many additional surgical and medicinal preparations.

WASTES

When we view the black dense smoke belching forth from chimneys, the stacks of mills, factories and locomotives, we are reminded that the waste must be, in the aggregate, enormous. In London, where estimates have been carefully made, the loss of coal in smoke when burned in open grates is between one (1) and three (3) per

cent. and that of the volatile matter is about ten (10) per cent. Careful firing in factories and mills and on locomotives reduce this waste, but while we have cheap coal and the Legislature permits the careless firemen to load the atmosphere with particles of unburnt carbon, we cannot expect to have these wasteful methods abolished. The beehive type of coke oven, so generally used in Pennsylvania, is one of the most wasteful contrivances ever invented, and from these thousands of ovens there have passed off into the air smoke and vapor which had they been saved, the value of the products would run into millions of dollars. Some day this waste may cease, but not, perhaps, for many years to come.

The appended table was prepared a number of years ago for private use. It has been found to be of great value and will prove so, no doubt, to such of our farmers who live and own coal lands in Western Pennsylvania.

CORRELATION TABLE

THE COAL MEASURES OF WESTERN PENNSYLVANIA

Compiled by BAIRD HALBERSTADT, *Engineer, Geologist and Prospector*, Pottsville, Pa.

Prof. J. D. Dana's Table of Formations.	Table of the Second Geological Survey of Pennsylvania.	Names Provisionally Adopted by Prof. Lesley.	Numbers.	Coal Beds in Each Series and Their Thickness.
Upper Coal Measures, ...	Upper Barren Measures, 1,100-1,200 ft.	Greene County Group, 300-400 ft.	XVII	Windy Gap (1′ 0″—2′ 0″), Nineveh (1′ 0″), Dunkard (1′ 0″—1′ 3″).
	Upper Productive Coal Measures, 350-450 ft.	Washington County Group, 700-800 ft.	XVI	Jollytown (2′ 0″—3′ 0″), Washington A (4′ 0″—5′ 0″), Washington (5′ 0″—8′ 0″), Little Washington (0′ 6″—0′ 10″), Waynesburg B (1′ 0″—2′ 0″), Waynesburg A (3′ 0″—4′ 0″).
		Monongahela River Series, 350-450 ft.	XV	Waynesburg (4′ 0″—10′ 0″), Uniontown (3′ 0″), Sewickley (5′ 0″—6′ 0″), Redstone (3′ 0″—5′ 0″), Pittsburg (4′ 8″—19′ 0″).
	Lower Barren Measures, 550-650 ft.	Barren Measures, 660-650 ft.	XIV	Little Pittsburg (1′ 0″—2′ 0″), Elk Lick or Barton (2′ 0″—4′ 0″), Platt or Crinoidal (1′ 0″—1′ 8″), Bakerstown or Price (3′ 0″—4′ 0″), Masontown or Brush Creek (0′ 6″—4′ 0″), Mahoning (1′ 0″—3′ 0″).
Lower Coal Measures, ..	Lower Productive Coal Measures, 250-300 ft.	Allegheny River Series, 250-300 ft.	XIII	Upper Freeport (E) (1′ 0″—6′ 0″), Lower Freeport (D) (4′ 0″—7′ 0″), Upper Kittanning (C) (0′ 6″—3′ 0″), Middle Kittanning (C) (2′ 0″—4′ 0″), Lower Kittanning (B) (3′ 0″—4′ 0″), Clarion (A) (3′ 0″—5′ 0″), Brookville (A) (4′ 0″—5′ 0″).
Millstone Grit, ...	Pottsville Conglomerate, 200-300 ft.	Pottsville Conglomerate series, 200-300 ft.	XII	Mercer, Upper (0′ 4″—2′ 6″), Mercer, Lower (0′ 8″—3′ 1″), Quakertown (1′ 0″—2′ 0″), Sharon (1′ 6″—4′ 0″).

REPORT OF THE ORNITHOLOGIST

By PROF. H. A. SURFACE, *Harrisburg, Pa.*

Mr. Chairman and Members of the Board: It is my pleasure and duty to submit the following as report of your Ornithologist for the year 1910. With but one exception, the year has not been characterized by any remarkable feature of Ornithology in Pennsylvania, besides the growth of that steady, strong and healthy sentiment for bird protection, for both practical and ethical reasons, which has been so valuable in giving Pennsylvania its deserved reputation for results in this cause. Only yesterday one of America's great agricultural speakers and writers, Mr. George T. Powell, in charge of the Extension of Agricultural Experimental Work, with office in New York City, remarked in this building that "it is recognized that Pennsylvania leads the Union in its strong sentiment and good results for bird protection." We must acknowledge that it is our opinion that this is due to the combination of three essential factors: First, public sentiment; second, judicious legislation; and third, the cooperation of all officials as well as private citizens for the proper enforcement of our laws.

The public sentiment has come, in great part, from the work of this Board, by providing that annually this subject shall be brought to the attention of our citizens through the Report of a Specialist in Ornithology, which is published and freely distributed, and the growth of this sentiment is further augmented by the Bulletins on bird preservation by the Bureau of Zoology, of the State Department of Agriculture, by the work of our Pennsylvania State Branch of the National Audubon Society, and by the work of Dr. William Dutcher, of New York City, and other officers of the National Audubon Society, produced by the use of Leaflet Literature, which has greatly aided in maintaining the interest and widely disseminating information concerning birds and other untamed creatures.

We should make special mention of the excellent work of our State Game Commission, with Dr. Joseph Kalbfus as Secretary, in creating sentiment, and especially enforcing legislation for birds and game protection. That law which made it illegal for an unnaturalized foreigner to carry a gun in the State of Pennsylvania has proven of vast benefit to our agricultural resources in protecting our song birds and insectivorous birds, and has likewise greatly aided our State forestry interests, as these birds are even more essential for the destruction of woodland pests than for the destruction of those of the field or orchard, because with our modern methods of pest suppression, we are able to control most of our injurious insects of the orchards by the spray pump when occasion arises, but this is practically impossible in the woods.

ARE BIRDS KILLED BY SPRAYING?

At this point we should offer an answer to the above question which is now so frequently asked. It is sufficient for us to say that we have

never been able to learn of any definite case of this kind, and if anyone should find dead birds near sprayed crops, where arsenical poisons have been used, and suspect their death to be due to this cause, we shall be glad to have such birds sent immediately to us at Harrisburg, by mail or express, for careful chemical analysis of the stomach contents.

Dr. E. H. Forbush, Ornithologist of the State Board of Agriculture, of Massachusetts, has published in his Annual Report of the State Ornithologist of that state for 1909, the results of his careful investigations along this line, after having very widely advertised for specimens of dead birds for analysis. His results are as follows:

"The investigations of the last three years have shown only two birds that were possibly killed by the arsenate of lead. When we consider the effective advertising that this investigation has had, the number of people who have been on the lookout for dead birds where spraying has been done, the few birds that have been received and the very small percentage (two birds) in the case of which the fatal poisoning by arsenate of lead seems even possible, it seems hardly worth while to continue the investigation."

BIRD COLONIZATION

Very successful results have attended the efforts of many persons who have attempted bird colonization, or at least who have done something toward providing for and retaining certain species of birds around their premises.

Among our recommendations in this practical and important line were the following: Erect for the wrens, small boxes or houses with the entrance not more than one-inch in diameter. This excludes the English sparrow. Erect boxes or leave old stumps or branches with holes for the bluebirds. Leave a few old snags for the woodpeckers, which are among our most beneficial friends in destroying the Codling moth and other insects of the orchard, as well as many forest tree pests. Plant a few of those shrubs, vines, bushes and trees that will afford, not only bird protection or concealment, but also bird food. Among these varieties are the service berry, also called "shad berry" and "June berry," and known botanically as *Amalanchier;* the hackberry, the wild grape, the English and American ivy, all possible varieties of mulberry and sweet, soft early cherry, such as the Governor Wood. Detailed statements of the methods of attracting birds were published a few years ago in the Monthly Bulletins of the Bureau of Zoology, a few copies of which are yet available for those persons especially interested. We were surprised and gratified at the showing of hands made last night in the meeting of the State Horticultural Association when Mr. Powell asked how many persons had wrens nesting on their premises. Over fifty hands went up.

THE ROBIN AND THE CHERRY

This has been the bone of contention, or *Bete noir* of the horticulturist. During the season while its young are in the nest and the robin must find food to meet its growing demand, ripe fruits of any kind are liable to be attacked. This can be avoided by planting sweet fruits which its prefers, and which ripen at the same season, such as the shad berry, the Governor Wood cherry, and early mulberry.

We have had many inquiries from persons who wish to aid the birds to colonize around their premises. The following is an example of a reply sent to an inquirer in Lock Haven:

"Replying to your recent letter concerning the erection of Martin Houses, I beg to say that the best way to induce the martins to nest around the premises is to erect houses suitable to their needs, and really I believe it is about the only means. These birds have no evil habits. They will not eat your bees, neither will they molest nor drive away your other birds. While they are wholly insectivorous, yet I have never known of a case of their being destructive to the honey bee. They are very interesting birds, and are worthy of your efforts for the propagation.

"If you wish further information on the subject, it would be well to write to Mr. Warren Jacobs, Waynesburg, Pa., enclosing forty cents for his booklet on Martin Houses, and Methods of Attracting Martins to the Premises. He has propagated them by the hundreds, and is very practical in his suggestions. I also shall be glad to aid you all that is possible."

In beginning this report we said that "with but one exception" the year has not been characterized by any remarkable feature of Ornithology in Pennsylvania. This exception, which becomes quite noteworthy because it is so remarkable, is the starvation of young insectivorous birds during the spring and early summer because the weather was so cold and wet that their parents could not find enough food for them. This is well expressed by a valued correspondent, Rev. J. R. Heckman, of Johnstown, Pa., who, under date of July 2nd, wrote: "The long, wet weather, with temperature much below the average, that has continued well up into June, has caused extraordinary happening, viz., the swallows were here about as in other years, but I have seen but one solitary swallow from the end of the cool weather up to the present time. It is thought that the unfavorable weather, probably, was a cause of the shortage of their food supply, which either caused them to starve or leave."

THE ENGLISH SPARROW

The English sparrow continues to be our greatest bird nuisance. Mr. Ira R. Foulk, of Schuyler, Northumberland county, wrote as follows:

"Is there any method of ridding our farm buildings and surroundings of the sparrows?

"Sparrows are very annoying to us. They harbor about the buildings in a large flock, and in the spring drive all other birds away from here, such as bluebirds, wrens, etc.

"Thanking you in advance for an exterminating medium, if there is any, I am,

"Respectfully,
"I. R. F."

To this I replied as follows:

"Replying to your letter making inquiry for a method of ridding your premises of sparrows, I must say that I recognize the objectionable feature of these birds, and agree with you that it would be well to suppress or destroy them. The U. S. Department of Agriculture has issued a bulletin on this subject which can be had free by writing to Washington, D. C., for it.

"One of the most successful means of destroying the English sparrow is to poison millet seed by soaking it a short time in a solution of strychnine and water, and then mixing some of these poisoned seeds with ten times their bulk of unpoisoned seeds, and put them where the sparrows can get them to eat, but where they will not be dropped on the ground to be picked up by poultry. Various kinds of traps and snares have proven useless for sparrows, for the reason that these birds are too shy to be caught in numbers in any device of this kind.

"Proper precaution in destroying or preventing nesting sites for sparrows is one means of preventing their multiplication around the premises. Often the corner of a building near the roof furnishes a place upon which a nest can be placed, while this could be prevented by boarding up or covering with a screen of coarse wire. Holes in walls or trees or buildings afford excellent places for sparrows to nest, but these could be closed by fastening over them a board with an opening one inch in diameter. This would permit the wrens to enter while the sparrows would be obliged to stay outside.

"It is not difficult to find the nesting places of these birds when they commence nesting in the spring time. A person can easily watch them and see them carrying straws, feathers, etc., to their nests. It is best to locate them, and then wait about two weeks, and then destroy them, and the eggs or young will be destroyed with them. Some persons go so far as to place favorable nesting boxes for the sparrows, where they can be reached and the contents removed at night at regular intervals during the nesting season. Thus the sparrows, not seeing the disturber of their nests, and not knowing it is a human being, are liable to continue nesting at the same accessible place.

"Four years ago Hon. Mr. Barnhart, of Johnstown, introduced a bill providing for the investigation of the habits of the English sparrow, and looking toward methods of its destruction. Very unfortunately this bill was ridiculed to death. It was, as you can see, a good and important bill, and would have been of immense value. I hope to see something further undertaken by this Legislature."

RABBITS KILLING TREES

There was considerable complaint last year concerning rabbits killing trees, and there is at present a popular tendency to paint the trunks of trees with axle grease to prevent this. Our recommendations have been against the use of axle grease on trees, for the reason that it is not of uniform composition, and while one brand may be safe on a tree another brand may destroy it. Also, there are known and tested methods of preserving the trees from injury by rabbits, and it is better to follow known methods, and leave the experimenting to those who are trained in experimental work, and will do it carefully and properly.

From a correspondent in Hanover, York county, we received the following letter:

"Last winter I used axle grease to paint young trees, and keep the rabbits and mice away, and I noticed it burnt the bark. Can you recommend something better."

Our reply was as follows:

"Replying to your recent letter, I note with interest that you injured the bark on your trees with axle grease applied last winter to keep away mice and rabbits. I have had this experience at other times, and this is why I have not recommended it. You do not state whether your trees are apple or peach, but I can say that you would have no difficulty nor bad results in painting your apple, pear and quince trees with pure white lead and raw linseed oil. It will keep the mice and rabbits away, and will also keep out borers, and will not injure the trees. I have used it on my peach trees without injuring them, but for some reasons can not feel sure in recommending it to others for peach and plum.

"Spraying or washing with the boiled lime-sulfur wash, home-made or commercial, will effectively protect your peach trees. Tramping straw down around the trees will protect them from mice, and cutting off branches from old trees, which may need to be pruned away anyhow, and dropping these on the snow in such a way that the snow will not entirely cover them, will often bait or feed the rabbits in such a way that they will not attack the trunks of the trees.

"Rabbits generally do not gnaw trees until the snow has been on the ground for some time. This will give you an opportunity to hunt them and destroy them. I certainly recommend killing rabbits as pests at any time of year they are to be found injuring an orchard. I understand that it is not against the Game Law if they are killed because they are injurious to the trees."

THE PROPOSED STATE GUN LICENSE LAW

The Game Commission and others have proposed that Legislation be enacted providing for the licensing of guns to be used for the purpose of hunting in this State. In general, it provides that a license fee of one dollar be paid by any person hunting in Pennsylvania, excepting on his own premises. This law would result in preventing hunting by many careless and irresponsible persons, and especially would make it possible for landowner to ascertain the name of the hunter immediately upon demanding to be shown his license, which according to the provisions of the law he is to carry with him when hunting. It would thus give protection to the farmer, such as he does not now have. At the present time it is impossible for us to protect our premises, livestock or families from the unknown gunners, who are often as fully bound upon errands of destructive trespass and petty thievery as upon the mission of hunting. We have no way of learning the names and addresses of such persons, and there is no method by which we can arrest them on the spot. To be obliged to go to town to swear out a warrant for their arrest, means to give them time to escape into the next township or county, or to other regions unknown, before we can return.

The Gun License Law would also provide funds for the payment of wardens and bounty, and would certainly result in giving the farmers better protection and increase game, which are desirable. We, therefore, recommend the co-operation of this Board with the Game Commission and others in securing the passage of such legislation.

LEGISLATIION FOR A LICENSE OR TAX ON CATS

It is well known that among the most destructive enemies of the birds in the populous residence districts, and on farms or orchards are house cats, which in many cases are half starved and run wild, are forced to capture birds for their food. If legislative acts can result in preventing the forsaking of cats along highways, abandoning them when moving, or permitting an increase beyond a desirable number, this will certainly be useful in bird preservation, and is, therefore, to be recommended. All of which is hereby respectfully submitted.

REPORT OF ENTOMOLOGIST

By PROF. FRANKLIN MENGES, *York, Pa.*

Insects of every description that usually infested this State continued their depredations during the year 1910, with as much fervor as in any previous year. The San José scale and all other scales, the aphides of every description, the potato bug, the cut worm, the loop worm, the wire worm, the cabbage root maggot, the apple and peach tree borers, the codling moth and the clover root borer, all of them and many others have plied their trade of destruction, and in many instances laughed at our poisonous interpositions. These in many instances were accompanied with fungus diseases more deleterious in their effect in many places than the insects.

The relation of insect and fungus diseases in plant life is so intricate, and in many instances with our present knowledge and with our instruments for observation well nigh beyond our ken. We know that in order that fungi may successfully attack plants, the plant substance must be in a condition to be attacked, and usually climatic and moisture conditions must be favorable for the special fungus to propagate itself. On the other hand when soil and climatic conditions are exactly right for the plant to grow and develop and ripen new tissue quickly, this tissue will be sufficiently strong to resist infestation and the infesting bacterium can do little or no damage. But, however salient soil conditions may be and however solubrious climatic conditions they do not prevent insect infestation, and when plants weakened and wounded by insect depredations the parasitic fungus has prepared for itself a way in the open wounds of insect attacks into which it can and will plant itself, and together insect and fungi will soon, if not checked, weaken the plant and make it valueless or entirely destroy it.

The San José scale and the bird shot blight are concomitants, and the potato bug and potato blight. In the case of soil conditions and fungus disease, the pear blight seems to be dependent well nigh entirely for its development on soil conditions. But not only do insects and fungi act as concomitants, but the insecticides and fungicides, the very substances used for the destruction of these enemies of tree and vegetable life, very frequently have deleterious effects. We take it that whatever the compounds of copper, whether as we used to think, it is the hidroxide, or as Prof. Pickering of England

thinks, that a series of basic sulphates are formed by the precipitation of the copper by the lime in making Bordeaux mixture, that when upon the trees or plants these become soluble by the action of carbon dioxide and moisture and therefore are present in the plant substance and available when needed to check the development of parasitic fungi. In other words the plant is put into a condition to resist parasitic infestations and insect depredations. As already stated whatever the conditions produced in the plant to resist fungus infection the substances that check this infection have a deleterious effect on the plant organs.

In a trial of tree spraying mixtures for fungus diseases, standard Bordeaux mixture made of four pounds copper sulphate and four pounds stone lime and fifty gallons water, Bordeaux mixture and iron sticker made of two pounds copper sulphate and four pounds iron sulphate and six pounds of stone lime with fifty gallons water, and self-boiled lime and sulphur made of ten pounds stone lime and ten pounds sulphur and fifty gallons water, the following results were obtained:

On the apple trees of the same variety in the same orchard on the same kind of soil those sprayed with the self boiled lime and sulphur the fungus diseases were not entirely kept down, but there were no obvious injurious effects on the trees. Those sprayed with the iron sticker and Bordeaux mixture the fungus diseases were kept down and there was little injury to the trees. But the trees sprayed with straight Bordeaux mixture were nearly entirely defoliated. These occurrences are not uncommon, but are by no means conclusive. The iron sticker, which by the precipitation of the iron in the sulphate by the lime water becomes the gelatinous ferrous and ferric hydroxides, is added to hold the insecticides and fungicides for a longer time and in this way prolong tree disinfection and insect destruction. It is obvious from this that in order that spraying in the future may be more efficient that the greatest care and keenest observatioon is demanded so that we do not inflict greater injury than the bacterium we are trying to destroy would have inflicted, especially is this so as long as we are obliged to use disinfectants that are injurious to the trees, the foliage and the fruit. I said disinfection of trees. I like the term because it brings us face to face with the conditions that confront the physician. He disinfects the room in which patients have been ill with so-called bacterial diseases in order to prevent the disease from being conveyed to others. Here another avenue for investigation opens up into which we have now not time to enter.

An illustration of the effectiveness of insect poisoning and fungus disinfection came under our observation in York county in 1909 and 1910. In one section of this county there was considerable complaint that Paris green did not kill the potato bugs and in some instances even Bordeaux mixture when applied sufficiently early did not in any way check potato blight.

In 1909 there was a scarcity of Paris green in the potato growing section of York county and dealers were obliged to scour the country to secure enough to supply the demand. Over 7,000 pounds were used in one section during this year.

In the vicinity of Hogueville and Cross Roads, York county, a number of farmers whom we visited told us how potato spraying had well nigh completely failed, in fact seemed to have done more harm

than good. Six samples of the Paris green used by as many different farmers were analyzed and the lowest percentage of arsenious oxide combined with copper was fifty-three and seventy-three hundredths (53.73) and the highest fifty-six and twenty-two one-hundredths (56.22), or 3.73 per cent. and 6.22 per cent. higher than required by the State law. This showed that the composition of the poison was all right and that the cause of its failure to kill the bugs must be due to something other than the composition, which was found to be the case. It was found that approximately twenty per cent. of these samples of Paris green did not pass through a screen of one hundred mesh to the inch. In order to make certain that finer grinding was necessary samples of finely ground Paris green were compared with these samples and where the finely ground poison was used the bugs were killed, while those on the plant sprayed with the analyzed Paris green were not killed.

This coarsely ground Paris green was mixed with water, even when constantly agitated the larger particles would sink to the bottom of the barrel and carry with them large numbers of smaller particles. But what was still worse, when these coarse particles were sprayed on the potato leaves they formed centers around which collected a large number of smaller particles making the Paris green so dense that it burned the potato leaves and prepared pores for the attack of potato blight. Not only is this coarsely ground Paris green the cause of trouble with potatoes, but it certainly can not be as effective for killing codling moth and other insects. It should, therefore, be insisted that the Paris green be ground to an impalpable powder so that it will easily pass into the cutting or chewing organs of the insect or larva; that it may be evenly distributed over the foliage and fruit of plants, that it will not burn the organs of the trees and plants and in this way itself do some of the injury for which it is applied and prepare the way for the attack of parasitic fungi as it evidently did in the case referred to.

These observations are not as conclusive as they should be, but from reports of other potato and fruit growers, it appears that we must learn better to prepare these spraying mixtures, or something else must be gotton instead of the sprays now used, that will not injure foliage, fruit or trees; but rather be a benefit such as the self-boiled lime and sulphur spray is.

SOME FUNDAMENTAL PRINCIPLES IN FERTILITY MAINTENANCE

By R. C. E. WALLACE, *Ohio Experiment Station, Wooster, Ohio*

"The soil is the farmer's business capital. He has invested his money in the land and to it he must look for his returns." What these returns will be depends largely upon the farmer himself.

If he is to adopt a profitable and permanent system of agriculture, he must put into practice the underlying principles which have been found to be absolutely essential and fundamental to the greatest

success in the production of crops. He must not be content to maintain the soil in its present state of fertility, but should, if possible, add to the fertility already at hand and thereby increase the productive power of the soil.

One of the well recognized means of bringing about this result—of increasing the productive power of the soil—is that of tile draining. The presence of free water is decidedly harmful to most plants, especially if allowed to stagnate near the surface. When the level of free water is near the surface of the ground, great benefit is almost certain to result from some system of underdrainage. So far as we are aware, none of our agricultural plants will send their roots below the water level; but by means of drains we can lower the water table and so increase the depth to which plant roots may feed. By lowering the level of the free water in the soil we not only increase the amount of root pasturage but open the way for the admission and circulation of air in the soil spaces; a condition absolutely essential to root development.

The admission of air to soils also assists in hastening the decay of organic matter and in the production of nitrates. A soil charged with surplus water is always cold, and the influence of drains in warming the soil is very decided, especially in the spring. More heat is required to raise the temperature of a given weight of water one degree than is necessary to cause the same increase in temperature in an equal weight of soil. Hence a soil surcharged with water remains cold in the spring much longer than well drained soils because the heat from the sun which should go toward warming up the soil is absorbed by the evaporation of moisture. The entire time allotted to this paper might well be devoted to a discussion of this question of drainage, but there are other factors to be mentioned relating to the maintenance of soil fertility, so that we may not linger longer on this phase of the question. But just in passing permit me to urge upon you the importance of thorough drainage. In my judgment it is the first and most important question to be considered in establishing a permanent and profitable system of husbandry.

TILLAGE

Tillage includes all the operations of plowing and preparing the ground for the reception of the seed and the subsequent cultivating of the soil. Good tillage is one of the most efficient means of assisting nature in rendering plant food available. The first effect of tillage is to improve the texture of the soil in the mere mechanical sense; that is, to make it fine and mellow so that the roots of plants may readily pass through it, and that air and water may be more readily admitted; thereby improving the conditions for root development and for the multiplication of beneficial organisms. Some soils are so stiff and heavy that neither roots nor water can easily penetrate them; others are so loose and open that they have very little capacity for retaining moisture. In either case tillage is highly beneficial, especially if accompanied by the incorporation with the soil of liberal quantities of organic matter. Surface cultivation and the establishment of a dust mulch is especially desirable during periods of drought at any time during the growing season.

Man has not yet reached the point where he can regulate the amount of rainfall which falls upon the earth; but by proper tillage

methods he can greatly assist the soil in absorbing the maximum amount of that which does fall and at the same time reduce the loss from surface washing; and further, by the establishment of a dust mulch he can in a large measure succeed in holding this moisture in the subsoil for the use of the crop in case of drought.

LIMING

As a means of correcting soil acidity, and as an aid in improving the physical condition of many soils, we have yet to find a substance that is more efficient or economical than ordinary builders' lime. When lime in this form is applied to a rather heavy clay soil it tends to flocculate the fine clay particles by cementing them together into small granules thus making the soil more easily tilled and less liable to bake and crack. In the case of a clay soil, this treatment serves to render the soil more open and porous, thus permitting a freer admission of air and allowing the water to percolate through it more readily. In this sense we can readily see that on such soils lime becomes an important adjunct to thorough drainage. On sandy soils, however, lime has an opposite effect. Such soils are frequently benefited by being rendered more compact, and hence have a tendency to become less leachy in character and to be more retentive of moisture. It should be the aim to increase the organic matter in such soils by the use of stable manure or by the occasional plowing under of green crops.

When viewed in the light of present experimental evidence, by far the more important reason for applying lime to the soil is for the purpose of counteracting the evil effects of free acids which may be present. When the remains of plants undergo decay upon soils deficient in carbonate of lime and magnesia, acid or sour humus is liable to be produced which is a condition particularly obnoxious to most agricultural plants. Such a condition is especially likely to occur when heavy crops of green manure are plowed down, particularly in hot weather. In such cases liming is an effectual and probably the most economical remedy.

Our experiments on Ohio soils have been shown conclusively that where an application of plant food is required some form of available phosphorous must receive first consideration; but where soluble phosphates are applied to soils deficient in lime and magnesia the phosphoric acid combines with the iron and alumina of the soil to form compounds that are not readily utilized by plants. If, however, the soil be fairly well supplied with lime and magnesia this transformation is retarded so that the plant is afforded an opportunity to utilize much of the phosphoric acid before it becomes unassimilable, the effect of the lime in this case being to assist in maintaining fresh applications of phosphoric acid for a considerable time in a more available form.

In many parts of Ohio, and especially throughout the entire eastern half of the state, it is becoming increasingly difficult to get a good stand of clover where no lime has been applied. On soils which have received a dressing of lime, however, clover will grow luxuriantly even though it refused to grow before the lime was applied. I would say, therefore, especially to those who have trouble in securing satisfactory crops of clover, that they might do well to investigate this question of applying lime to the soil as I should expect much benefit from its use in cases similar to those which I have indicated.

ROTATION VS. CONTINUOUS CULTURE

(For this portion of his address Mr. Wallace displayed a number of charts showing in detail the results of the experiments discussed.)

At the Ohio Station we have two series of tests which have now been in progress for seventeen years, that present some interesting facts as to the value of rotation as compared with continuous cropping both with and without the use of fertilizers and manure.

In one test we have established a five-year rotation of corn, oats, wheat, clover and timothy, and in the other corn, oats and wheat, each having been grown continuously on the same ground for the entire period of the test.

Under rotative cropping the average unfertilized yield of corn has remained practically unchanged for the entire period. The average annual yield at the end of the first five-year period was 31.89 bushels per acre; at the end of the third period the yield was 31.04 bushels per acre—less than a bushel difference between the first and the last period—a difference so small as to make it unsafe to attach to it any particular significance. In the continuous culture plots, however, both the unfertilized yield of corn and wheat show a rapid decrease in yield, the average for the third period being only about half that of the first.

On the fertilized plots the nitrogen is applied at the same rate per acre as Plot 11 in the rotative cropping, and on Plot 2 in the continuous culture, but the corn and oats grown continuously receive more phosphorus and potassium than the same crops in the rotation. At the end of the first five years the corn had yielded slightly more, on an average, in the continuous than in the rotative cropping and the oats and wheat nearly as much. During the second and third period, however, all the crops in the rotation have made steady and constant gains while the yields on the continuous culture plots have, with the exception of oats, been gradually going down, notwithstanding the heavier application of fertilizer. In the following table are given the yields for each of the three five-year periods both for Plot 2 of the continuous cropping and Plot 11 of the rotation:

Crop.	Continuous Culture, Plot 2.			Five Year Rotation, Plot 11.		
	1st 5 years.	2nd 5 years.	3d 5 years.	1st 5 years.	2nd 5 years.	3d 5 years.
	bus.	bus.	bus.	bus.	bus.	bus.
Corn,	44.61	47.20	38.50	41.28	49.90	54.13
Oats,	42.22	40.11	45.46	43.61	52.48	53.49
Wheat,	19.78	21.90	17.41	20.53	27.46	33.10

In the case of plots receiving barnyard manure comparison is made between Plot 20 in the rotation work, which receives a total of eight tons of manure every five years—four tons each on corn and wheat—and Plot 6 of the continuous culture which gets five tons of

manure every year, or twenty-five tons for the five-year period. This rate of manuring has caused the corn yield to rise steadily from less than 39 bushels per acre for the first period, to more than 50 bushels for the third under rotative cropping, whereas the corn under continuous culture has fallen from 43 to 34½ bushels during the same period despite the fact that the plot growing corn continuously receives more than three times as much manure every five years as the corresponding plot in the rotation received for all the crops grown during the same period.

In the rotative cropping the oats crop is not directly manured, receiving only that left by the preceding corn crop—and, so far as I am aware, all our experiments agree in showing that the crop which is directly manured or fertilized receives the major portion of the benefit from the treatment—hence the comparison in this case should be made with Plot 18 in the rotative cropping, which receives eight tons of manure each on corn and wheat, or sixteen tons every five years, against the twenty-five tons applied directly to the oats continuously during the same period. This secondary effect on the oats, of manure applied to the preceding corn crop is shown by the results to be even greater than is the direct effect of the larger quantity applied directly to the oats as we do in continuous culture.

The manured wheat shows a little larger yield in the continuous than in the rotative cropping during the first period. At the end of the second period the wheat in the rotation was slightly ahead of the continuous, while at the close of the third period the yield of the continuous wheat was little more than half that in the rotation.

It thus appears that not only has there been a much greater decrease in the unfertilized yield under the continuous than under the rotative cropping, but that the effect of fertilizers and manure has been much less on the crops grown continuously than on those grown in rotation.

It has not been uncommon during the progress of our fertility work at the Ohio Station to frequently have grave doubts expressed as to the applicability of our plot methods to practical farm operations where fields several acres in extent are cultivated. In order to demonstrate that the plot methods were as entirely applicable to large as to small areas, we began putting into practice on a 40-acre field some of the lessons we have learned from our plot work. This forty-acre tract is divided into four sections of ten acres each on which is practiced a four-year rotation of corn, oats, wheat and clover. For the first ten years after the establishment of the Experiment Station in its present location our practice on this field was to top dress the ground for wheat in the fall, with ten tons of barnyard manure, the other crops following without any further fertilization. Seven years ago we adopted a different plan and began putting into practice some of the lessons above referred to. This consisted in applying ten tons of phosphated manure per acre to the corn ground in the fall, at a cost for raw rock phosphate used of $1.60. After the ground was plowed in the spring we applied one ton of lime per acre, costing $6.00. In the fall the wheat ground received a dressing of 400 pounds per acre of fertilizer analyzing 4 per cent. ammonia, 16 per cent. phosphoric acid and 5 per cent. potash, all costing $6.40, making a total cost of $14.00 per acre for the entire rotation.

In comparing the results of the two methods we find that for the first ten years before the change of plan the average yield per acre

for the entire period was 48 bushels of corn, 52 bushels of oats, 20 bushels of wheat and 2.7 tons of hay; the average of the last seven years since the adoption of the new method, has been 73 bushels of corn, 56 bushels of oats, 37 bushels of wheat and 3.7 tons of hay. Figuring the total value of the increase at the average of prices for the past few years we get a total of $64.00 for the gain. The cost of treatment we have seen is $14.00. The net gain therefore would be $50.00 per acre for the four crops of the rotation, or $12.50 per acre for each crop each year. This is a greater net return than has been received from any of the plots under test at the Ohio Station, and demonstrates conclusively that good tilling and thorough fertilization are fully as practicable and applicable to large as to small areas.

REPORT OF THE BOTANIST

By PROF. W. A. BUCKHOUT

The activities of your Botanist have been directed entirely to correspondence. This varies little from year to year, and generally runs somewhat parallel to the season. Some lines of inquiry are not at all seasonal, but those most frequent are. In spring and fall specimens of seed for purity and character are quite abundant, and during the height of the growing season weeds or conspicuous native plants for naming come in quite rapidly, generally coupled with the inquiry, how can they be exterminated?

Of the miscellaneous inquiries, those relating to special crops are the commonest, and of them mushrooms and ginseng take the lead.

Of the former, the following correspondence expresses my judgment so tersely that I venture to quote it entire, although the context shows that it has already been in print:

To Raise Mushrooms

To the Editor of "The Press."

Sir:—Can you give me an answer to the following questions regarding mushrooms?

1. Are they hard to raise?
2. Is raising them profitable?
3. Is there a good market for them?
4. What price do they bring?

Will be glad to receive any information you can give me on this subject.

A. F. H.

Philadelphia, August 29, 1910.

This question was submitted to the Pennsylvania State College, and Mr. W. A. Buckhout, of the Department of Botany of that institution, sends the following reply:

"Replying to the inquiry of your correspondent 'A. F. H.' respecting mushroom growing, I would answer as follows:

"1. Not particularly, for those who understand the business.

"2. In the long run, yes, but partial or even complete failures are not uncommon.

"3. The market is rather narrow and select.

"4. The rate, 15 to 50 cents per pound, wholesale, is about the winter's range.

"Your correspondent is evidently a novice. If he desires to proceed further in the matter he should do two things. (1) Visit some mushroom growing establishment and study it thoroughly; (2) write to Department of Agriculture, Washington, D. C., for Farmer's Bulletin No. 204, 'How to Grow Mushrooms.' Mushroom growing is no more like ordinary cropping than cattle raising is like oyster culture."

I should give substantially the same advice regarding ginseng, golden seal, peppermint and others. Each is in a special class by itself, and no one should expect to be able to handle it successfully without the special knowledge which careful observation and experience give. But, over and over again, someone chances on the highly seductive advertisement or newspaper tale of the making of "big money" on a small plat of ground in raising this or that special crop. Deceived by the more or less exaggerated accounts, which carefully avoid any reference to the need of caution, and gratuitously offer their one-sided experience, some, I am satisfied, rashly make the venture which only the most dogged persistence in the face of years of discouragement can turn to success. The same time, money and energy put into some of the albeit common crops would generally give, in the long run, more satisfactory returns.

It is gratifying to see that the necessity, as well as the advantages of pure seed, is becoming increasingly evident to farmers and gardeners. Many have come to have a wholesome fear and dread of dodder, and hence to scrutinize clover and alfalfa seed very carefully before they use it, and to require some warrant that it is free from at least this pernicious pest. Weeds, like the poor, we shall always have with us, but reasonable care in the purity of seed used, careful cultivated crops, and due regard to maintaining soil fertility will so hedge about and restrict them that they need not be feared. I have little faith in the practicability of weed destruction by spraying, at least under the ordinary conditions which appertain in Pennsylvania, whatever may be the case in the large, uniform, unobstructed fields of other regions.

When one considers the resisting power possessed by our old weeds so long entrenched and habituated to their surroundings, it seems idle to expect to control them except by the most vigorous counteracting measures, such as have been used for all time. Spraying with iron sulphate, salt and the gardener's weed killers of various sorts may have their place, but only where the conditons are fit, and then one must carefully count the cost of machinery, materials and time, or he will be left in the lurch. Unsatisfactory as such replies may seem to be to my anxious inquirers, I can seldom answer them in any other way. So long as life is a struggle and a competition, so long must the obstreperous weeds be crowded out and kept out by stimu-

lating our useful plants to their most vigorous growth. Specifics have small place in weed killing.

From time to time I get specimens of grass containing ergot or spurred rye. So characteristic and so plain are such diseased grains that it seems strange so few farmers or farmers' boys recognize them on sight, the more so since ergotted grains are such insidious poisons and in all probability are the frequent causes of the sickness of animals and sometimes of their death. It is true that well conditioned animals with a liberal food supply are generally discriminating enough to reject ergot, but it must sometimes happen that an over hungry animal or a weaker animal crowded by its fellows may snatch, hastily masticate and swallow the ergotted material which, if at ease and leisure, it would reject.

In the last few years I have had several cases of ergotism reported to me, and your veterinarian has likewise recorded a number of very pronounced examples. I shall not take your time to rehearse them, but should any of you be directly interested you will find these cases in former volumes of your proceedings; my own in Report of Pennsylvania Department of Agriculture, 1906, page 340, and that of Dr. Pearson in the Report for 1902, Part 1, page 161.

Few instances could more conclusively show the value of some practical knowledge of botany and zoology. We are making some progress in getting such facts as these before the people, and in getting the people stirred up to pry into such matters for themselves. But the losses to farmers due to ignorance of natural phenomena and natural principles is still appalling.

REPORT OF ECONOMIC GEOLOGIST

By DR. ISAAC A. HARVEY, *Lock Haven, Pa.*

Speaking in a general sense, perhaps no other branch of natural science is so much neglected, and hence so vaguely comprehended, as geology. This fact may be due, in a great measure, to the broad range of its meaning and the wideness of its scope, by association with the other sciences, as well as the difficulty of attaining an intelligent knowledge of its details, and from the fact that, commonly, we are more interested or anxious to learn or know more about those certain branches of knowledge or science that can be more readily learned or utilized and afford promise of more immediate pecuniary profit or advantage.

Will it pay? is a query that seems to dominate the average American mind and explains much of the indifference with which we regard one science and the zeal or earnestness with which we pursue or study another. Hence, when the question of the mineral resources of a given locality or district arises, in very many instances, the residents and land owners are not prepared or much concerned to investigate, estimate or even conjecture what minerals of commercial or economic value may be obtained in the rock strata as they may

outcrop on their properties. They are not so much interested in the possible minerals beneath the surface as they are in the matters and affairs above the surface; and this fact suggests many instances of the dense and ridiculous ignorance of this science that have come under my observation while engaged in making investigations and researches in various counties and states.

Almost anywhere or everywhere I have found people who can relate stories or traditions of supposed or reported minerals of fabulous quantity or value, and often have I been assured that coal, iron ore, gold, silver, lead, copper, zinc or other minerals are really present or to be found in certain places or localities; only to be revealed, however, to me or some one else, upon the payment of a round sum of money; and, the money not being forthcoming, the knowledge of the whereabouts of the reputed mineral discovery disappears with the man "who knew all about it;" but, who, nevertheless, went away or died in penury and poverty without even disclosing the facts to his indigent and helpless heirs.

The absurdity of very many of these tales, geological legends and traditions, is made evident and manifest to one having some practical knowledge of geology, by the fact that the reported deposit is usually said to be in some strata, mountain, hill or valley, whereof the rock exposures, geological structure or period absolutely forbid the presence of such mineral, or wherein it is not possible for such values to be present from the very character of the formations thereabouts. These various tales afford no small diversion and amusement during the somewhat irksome labor of exploring or prospecting properties, and it is wonderful what credulity and expectation in outlandish places. Some are sincere and honest: others are engaged in deliberate deception. Thus, a certain squatter and hunter, in one of the adjoining counties, related to me how he had discovered coal, iron ore and other valuable mineral deposits, among which was "a bed of steel four feet in thickness." Having some knowledge of the man's thieving propensities, for he had such a reputation, I was disposed to say that I knew where there were six feet of steel (steal); but my misgivings about the effect of such a remark restrained me from making it, as a passage at arms, at that place, would not have been to my advantage. A local preacher in Cameron county agreed to show me where he had opened four feet of coal, but when we arrived at the place and he reopened the pit, evidently sunk many years before, no coal appeared and none could have been formed in the rock period in which he had been digging. This seemed to be a clear case of geological fancy, dream or delusion, as the man was of good repute and evidently sincere.

Men of this kind, and harboring such fallacies and notions, are to be found in almost every community; such, for instance, as the young man in one of our small towns, who found (?) an excellent specimen of gold quartz while sitting near a spring under a ledge of rocks; others in our county, and doubtless in most of the other counties, who have discovered magnetic iron ore in large amount and have shown splendid samples thereof to credulous, though intelligent, merchants, lumbermen, farmers, and occasionally even a lawyer. These smart "Alecs" and local prospectors, of their kind, usually know, or profess to know, the whereabouts of the ore, but fail to show it; and the deception intended or the ignorance that besets the minds of

these fakirs is obvious from the fact that magnetic or red hematite iron ore, or other mineral claimed as stated, has very rarely or never been found in the rocks which are represented where these men profess to have located the said minerals, and the samples are too pure and rich for outcrop ore. Specimens of nearly every conceivable kind of rock or mineral, so called, have been sent to me for inspection and opinion, and, in nine instances out of ten, they are worthless. I have very frequently been asked to examine a certain tract or property where, as tradition has it, the Indians were wont to find lead or silver, or both, and assurances are offered me, orally, that other minerals are nearby, and there is such a medley of these things in my experience, that the vagaries attending the notions seem, oftimes, to indicate a species of dementia, even beyond the incidental delusions that may, for a time, possess the minds of others who are misled in these matters.

Now, while the minerals are not absolutely excluded in all instances by our geological experience and knowledge, from the strata named as containing the "fine prospects" affirmed, yet the matter of discovery, as described, and the vagueness that attends the information relating thereto, constrain me to yield very little credence to any of these fables or reports, unless some additional or more definite evidence is afforded of their truth.

Good samples of magnetite or hematite may be found on the cars, passing through the town or village, and the same will serve the purpose of "truthful James" in his efforts to mislead and in his geological researches, and he carries his specimens with so much assurance, for the inspection of "gullible" people, that one can hardly question his honesty or sincerity, unless possessed of a fair knowledge of the geological conditions at the place of supposed discovery. Some fine gold or silver, or perchance, copper ore, received furtively from friends in the West, may afford the basis for a fortuitous or anamalous discovery of kindred quartz or ore not far from the city, town or village where these cranks have their abode. So it is, also, with lead, zinc, marble, etc., and the finding of a lump of iron pyrites, as bright and beautiful as gold itself, is sufficient to make a fool of the finder and perchance, many fools among his neighbors; for iron pyrites has deservedly the name of "fool's gold."

Of geological cranks there seems to be quite as many as there are of the typical religious cranks and both peradventure, of equal blessing and advantage (?) to the communities wherein they may dwell. Such there are, many of them, who can discover imaginary values in nearly every stratum or layer of rock, or even stone and in the hill, valley or mountain; and many times their geological supersition, for such it may be called, leads them hither and thither in search of undiscovered mineral wealth of which they dream, in wild and fanciful error and delusion through a lifetime of penury or indolence. Many people intelligent and successful in business, farming, mercantile, professions, have been persuaded by such "big prospectors" to believe in the probable presence of valuable coal, ore or other mineral in places where such deposits have never been found by subsequent investigation. It is for this reason that I have adverted to the hallucinations, fallacies and absurdities of some prospectors and pretenders, who seek, either blindly or ignorantly, for mineral values and wilfully mislead people who have given the subject very meagre

thought or study, when a moderate knowledge of geology would enable them in most instances to locate anything of value or readily determine, at least, whether an investigation is wise or expedient.

In my library at home are books containing thousands of pages descriptive of oil and gas, their genesis or origin, and the wells through the State, many dry and some productive. Of these two important factors of manufacture and commerce as well as of domestic convenience and comfort, doubtless, there are accessible in our public libraries many books containing elaborate discussions of the same subject and covering in the aggregate fully ten thousand pages. However, it seems to me, as one having given the matter of production and continuance of the oil and gas supply, that there is no other problem in the wide domain of practical and economic geology that is further away from entire knowledge and perfect comprehension or solution, and no other subject in this science that so much engages the close and assiduous study and attention, in the gas and oil producing states at least, as the one relating to the location, intelligently and accurately, of productive wells thereof, and ascertaining the certain trend and probable extent of the oil and gas pools or reservoirs, so-called, and the length of time in which they may be expected to afford a supply for practical use.

In our State, as well as in others,—and notably Virginia and West Virginia—we have the history of the appearance, more than a century ago, of oil or gas or both issuing in a meagre way from their subterranean source or origin; and, later, the actual finding and locating of some of the pools by tentative or experimental drilling in certain districts. But not until the very recent years were wells located and the valuable results obtained upon any definite geological deduction, rule, method or indicated facts, whereby the driller could intelligently select the site or position of his well with reasonable cartainty of a favorable response to his efforts.

Hence, the investigations, formerly, were left entirely to the somewhat erratic discretion or notion of men, who, without any distinct ideas or knowledge of geology, were seized, perchance, with the vague and indefinite idea of "putting down wells" to find gas or oil, and declining the suggestions of geologists, who in a limited sense at least, had scientific views of ideas with reference to the actual location and approximate depth from the surface of these desirable products of the rocks and sands; and who, also, by degrees acquired such additional data and facts from the experimental drilling as to deduce such definite and positive conclusions that eventually became a guide to the driller, who, formerly, was wont to ridicule and disparage the scientific views or aspects of the subject and make sport of the well read and carefully trained geologist, his rules, formula and science.

Without any claim or assumption of a thorough knowledge or mastery of the oil and gas question, nevertheless, I have never been impelled to venture into a theory that would define the approximate limits of the "oil and gas fields" or in any sense approve a map, at best conjectural, that would purport to circumscribe or measure the territory whence these products might be derived. The possibilities of paying wells have been so much extended and increased and the outlying and isolated oil or gas districts and the "lonely" productive wells are so far apart from the original districts as traced on the

maps, long since published, that one at this late day who would assume to conjecture or figure absolutely what extent of territory is barren and what productive, may justly be termed a tyro, fakir or empiricist and places himself within the province of rational, consistent and scientific geology and acquired truth in that respect.

The theory that oil, with its associated gas, is only found in a trough or basin, while the gas alone may be located on an anticline, its slope or arch, by certain drillings, does not obtain everywhere, and the assumption that oil cannot be found on the slopes of anticlines has been nullified by recent experience and by the highest scientific authority. But the contention yet remains, with very many people, that gas alone should be sought on the slopes and arches of anticlines, as being derived from oil in the basin proper and finding its way from the oil pools to the slopes and arches through continuous rock fissures, the oil, of course, being supposedly present in or near the bottom of the trough; that is, close along the cynclinal axis and one or more miles from the point where the gas issues from the well, as drilled. In other words, the oil should be in the trough between the anticlines that have their respective crests on each side of the basis of the trough. The facts that might seem to establish a theory and distinguish it as a rule to be applied with exact certainty and verification in certain localities, or even states, may not suffice for a certain guide or rule in other localities or states.

Much remains yet to be learned and proved by years of experience and careful investigation, and the somewhat exceptional and anomalous discovery of gas and oil beyond the assumed limits of a district or basin and located by guess or random, affords no basis for a methodical drilling by a rule or assumed sequence derived, in part, from the well known and thoroughly tested fields where the trend and outline of the oil pools, at least, may be fairly understood and surveyed.

Such isolated distircts as Gaines, in Tioga county, have no precedent in the discoveries of many years ago, but, however, much oil or gas may be hereafter derived from this field, the very pertinent query arises, whether along the trend of the several wells that have been productive and ceased as of those that still afford some oil, there may not be other localities northeast or southwest, that will, in some measure, greater or less, respond favorably to the drill. Therefore, we may logically expect new efforts, made in an intelligent manner, to be repaid by the revelation of new fields.

Broadly speaking, geologists have so arranged and formulated the great mass of information, otherwise not so accepted, as to be able to afford to the driller more definite suggestions as to the locality that promises success, than the driller is willing to accord to the geologist.

In some measure, the experimental driller towards the finding of oil or gas may hereafter realize the advantages of consulting a good geologist, as in other fields of that science, such as coal, iron ore and many other minerals, concerning which the geologist alone has any clear and positive knowledge. I remark, also, that the oil and gas of Russia, Canada, Texas, California, Pennsylvania, West Virginia and many other states and nations, are mostly found in different formations; so that we are not so free to deny the presence of oil or gas in those strata that have not yet proved productive and which,

while not encouraging any expensive investigation, may, nevertheless, in a local way, contain oil or gas or both; such, for instance the Findlay district, in Ohio and Indiana, wherein the Lower Silurian Limestone formations supplied for a long season and may yet furnish gas and oil, much to the surprise of geologists; these limestone rocks being variously from 12,000 to 15,000 feet geologically beneath our Devonian rocks which supply most of the oil and gas in this State. Moreover, it appears that our oil and the oil from many of the states and countries is largely of vegetable origin, while a notable exception is found in one district at least in California, where the fact that the oil will nurture larvae seems to indicate the marine animal as its main source, while, of course, California has other fields porducing oil similar to our own, but, as is the case with many other states, the California oil is inferior to ours in commercial value and various products.

It is well to bear in mind the facts herein stated, and realize that it is only by the gradual process of investigation, drilling and careful study that we acquire additional knowledge and discover new fields of oil and gas for our present benefit, and much yet to be disclosed for the well being of those that succeed us and whose names as well as our own have long been "written in the book of Creation."

THE PEAT BEDS OF NORTHERN PENNSYLVANIA

By DR. WM. FREAR, *Chemist*

Mr. President and Gentlemen of the State Board of Agriculture:—Pennsylvania with her constant increase in population places upon the farmer the responsibility for providing a steadily increasing food supply, in which variety as well as quantity must be regarded as important factors. As far as conditions of production and transportation will allow, these supplies should be produced within our own borders. In view of the growing food demand, it is of great importance to the continued prosperity of the State as a whole that not only the methods of handling her present cultivated areas be improved, but also that the great areas within her borders that have not yet been brought under subjection and planted with food crops, be carefully studied to the end that they may be used for such purpose wherever their nature is such that they may be used for such purpose contribute to these supplies. The recent work by the State Experiment Station in co-operation with the United States Bureau of Soils in the study of the lands adaptable to the production of the apple and peach represents one promising effort of this kind. There are, however, numerous other promising subjects of study having the same end in view. Among these the development and use of the peat beds of the State are worthy of serious consideration and, judging from the growing number of applications made to the Experiment Station for analysis of these beds, public interest in them is growing.

There is unfortunately no survey of the State such as enables us to give at this time the total areas occupied by such deposits. In the various surveys of the State, these peat bed areas have been grouped with bottom lands in such a manner that the areas occupied by the latter and the peat beds respectively cannot be determined from the data published. It has been thoroughly estimated, however, that as a whole these beds cover not less than 75 square miles. All over the regions of the State covered by the glacial drift there are numerous lakelets filled from the drainage basins formed by surrounding steep hillsides, the entry of the water into the lakes often being by springs discharging upward into their bodies the sub-surface flow contributed by the higher land surrounding. These lakes have commonly been formed by dams of glacial drift deposited in the ravines of which the lakes form heads and the lakes discharge the excess of the water they receive through small streams flowing sluggishly over the tops of these dams.

Some of these lakes are shallow, because they were not deep to start with or because they have been filled with wash from the adjacent hillsides; others are still deep bodies of cold water. Because of the obstructions they alike possess both the shallow and deep lakes are marked, however, by only a slight current movement. Under these conditions many of them have gradually filled in with vegetation. The course of development of this vegetation consisted first in the formation of a growth of algae and related organisms over the water surface. The vegetable covering gradually thickened and presently came to support other growths, more especially those of the mosses. The weight of these later layers caused the undermost gradually to sink. This sinking often took place most rapidly near the shores of the lakes. As this succession of vegetation went on, the thickening layer of decomposing plants and the mineral wash from the surrounding uplands that is from time to time received in quantities varying very greatly according to the surroundings, in many cases, particularly of the shallower lakes, completely filled their depressions with a mass of vegetable matter; in other cases the vegetable layer became not only continuous but sufficiently coherent to support the weight of men and even of the larger domestic animals, although underneath the mass remained great depths of lake water. Through and under these vegetable formations the excess of lake water continues to seep slowly into the small streams that sluggishly work their way through the outlets earlier described. The character of the surface vegetation of these vegetable lands has changed from time to time, and today many support thick growth of flags, sedges, and bushes like that of the cranberry, but very rarely the heavier growths of trees. In a great many cases, the shores of the lake are fringed with bushes which have not, however, pushed out from the shores on to the bogs or peat beds just described.

These soils, together with those of swamp lands, are commonly classified as *cumulose* soils. In many particulars they differ from the other soil classes composed chiefly of mineral materials, their adaptation to crops is very much more limited than in the case of mineral lands, and the methods of their treatment also are peculiar. They have, however, marked fitness, under favoring conditions, for certain important crops, and contribute, moreover, raw materials of considerable value to a number of growing industries. In view of

the increasing interest in the composition of these beds shown by the Station's correspondence, of the greater experience now available to guide their cultivation, and of the development of technical uses for their materials, I have thought it fitting to speak briefly upon some points relating to the preparation and cultivation of these cumulose soils and also concerning a few of their technical uses for certain of their products.

As a fundamental fact limiting and at the same time suggesting their adaptations, it should be recognized that these soils are formed almost entirely, or at all events chiefly, of vegetable matter which has decayed without the full access of air and that its raw materials have, for the most part, consisted of plants rather deficient in those mineral materials to deficiencies in which our ordinary field crops are particularly sensitive; and that furthermore, for a long period of time, these decaying plants have been leached by slowly trickling bodies of water so that such of their mineral materials as became soluble during the decay, were likely to be removed by the leaching process. Because of the small degree in which air had access to them during their decay, these vegetable masses suffered a putrefactive decomposition, rather than that gentle oxidation most favorable to the conversion of plant remains into food suitable for succeeding plant organisms. The putrefactive conditions have gone on very slowly and while they have resulted in the loss of carbonaceous materials and also of some nitrogen, they have left residues rich in the latter element. Owing to the exclusion of air, the mineral materials of the decaying plants have been reduced rather than oxidized. The iron they contain, often in considerable quantities, has been either largely removed from them to lower strata, or has been held in the form of iron pyrites. The organic matters which remain are largely acid in their character, and, while little is known of the individual substances forming the organic complex in these soils, experience has amply proven that they are not in condition to favor the growth of ordinary crops, but rather to injure plants of such species.

As a rule the upper layers of these cumulose soils are dark, sometimes almost black in color, while the lower layers, less freely exposed to the air, are brown in tint. The upper layers are often covered by mossy growths, commonly those of the *Sphagnum* species, but the main body of the mass exhibits only faint traces of the organisms from which it was derived, except in the case of occasional large woody roots which found their way among the other vegetation. In some cases the material is of a dry, semi-resinous, or pitch-like consistance.

From the agricultural point of view the most interesting quality of these soils is their richness in nitrogen. This element is not present, it is true, in such condition that it is ready without important changes to contribute to the nourishment of ordinary crops; but the changes which must be brought about are such as can in many cases be quite readily accomplished. In lime, phosphoric acid, and potash, particularly the latter, the cumulose soils are particularly deficient, and it is, therefore, a condition to their successful use for agricultural purposes that liberate quantities of these less expensive fertilizer materials be supplied. In a few instances, considerable quantities of calcareous matter have been contributed to the cumulose beds in the wash from the neighboring hillsides; but the latter

themselves throughout the glacial regions are not marked by any special abundance of lime compounds. For this reason, the wash, even when it forms a very considerable fraction of the cumulose soil, rarely contains enough soluble lime to change materially the character of these soils so far as concerns the supply of lime necessary for their conversion into productive lands. It is, as I have said, to their nitrogen that their agricultural value is due. This element, present to the extent of but .05 per cent. in heavy clay subsoils, averaging about .15 per cent. in good arable lands, and rarely exceeding .25 per cent. in old meadows, amounts above 1 per cent. in these cumulose soils and sometimes reaches two to three times that amount or even more. Studies made at the Station of the conditions in which this nitrogen exists, show that the various beds so far examined differ quite materially in their proportions of what is termed active humus; that is, of organic material capable of solution in dilute alkali. In ordinary lands where the active humus is abundant it is believed that the plant remains constituting the humus are in the highest degree available for the support of succeeding crops. In the cumulose soils most of the organic material is inactive, so that the nitrogen is especially resistant to the natural processes tending to make their nitrogen available. In other cases, however, the proportion of active humus is quite considerable, and included therein may be found an important fraction of the nitrogen content of these soils.

Several points concerning certain of the physical properties in which the cumulose soils differ especially from the soils of other classes, may be noted in this connection. Respecting their heat relations, it should be observed that the soil temperatures are governed by the comparatively large amounts of water these soils contain, both when in their normal state and when best perpared for cropping. Schübler showed that, doubtless owing to their dark color as the principal influential property, garden mould and humus soils attain, when dry, higher temperatures upon exposure to the sun than do other soils. This is because it takes less heat to raise the temperature of humus than it does to increase those of clays, sand, etc. For Ulrich has shown that the quantity of heat required to increase by one degree the temperature of dry humus is about one-half that necessary to cause a like elevation of temperature in equal weights of clay, chalk, or sand. The power of these organic soils to transmit or conduct heat from one point to another is also much less than that possessed by the principal substances in mineral soils, as has long been known and recently very carefully proven by Patten.* All these data refer, however, to dry cumulose soils, and are of greater scientific than practical value because, by reason both of the location of these soils, their relation of bodies of water, their usually low lying position with respect to surrounding lands, and also because of their water requirements under cultivation, the cumulose soils are, in practice, dealt with only in the moist condition. As a matter of fact, these soils are cold, thaw out late, have a very short growing season, and are especially subject to late spring and early fall frosts; their common location near the foot of steep hillsides, renders them particularly open to the influence on quiet nights of cold air drainage, which intensifies conditions otherwise favorable to frosts.

Harrison E. Patten. Heat Transference in Soil. Bull. 59, Bureau of Soils U. S. D. A.

32—7—1910

The water relations of these soils are especially important. They have, in the first place, a very large water-holding capacity; that is, power to hold water without dripping. Those layers which are open and spongy, particularly those composed chiefly of mosses little decomposed, have an especially high water capacity amounting in some instances to upwards of six times the weight of the soil, or four-fifths of its dry volume. As the organic materials break down, however, they become less spongy, with a corresponding decrease in their water capacity, which nevertheless amounts in many cases from one hundred and thirty to one hundred and sixty parts by weight of the soil or from fifty-five to sixty-seven parts by volume. Their resistance also to the passage of water from one point to another in either a horizontal or a vertical direction, differed with the degree to which they have been decomposed, the movement being much more free and rapid in the more porous, little decomposed soil. When the compact, decomposed cumulose soil is broken up by cultivation instruments, its capillarity, that is its power to lift water through its pores, is distinctly increased. Another fact of special importance is that, once these soils are dry, they take up water very slowly, particularly when they are reduced to a fine dust, which is readily produced by the too frequent treatment of the surface of these soils with fine cultivating tools. Because of the slowness with which they recover from a drought and of the fact that they give up their water with considerable reluctance to growing plants, it is particularly important that the cultivation and management of the water relations in these soils be very carefully and systematically controlled.

Another of their physical properties requires mention because of its vital importance in limiting the range of production of these soils,—that is that they exhibit a very great change in volume as they dry or become wet and especially as they freeze and thaw. As a result biennial plants or others that occupy land through the winter are especially likely to be heaved out; hence, these lands are not usually suitable for the production of winter grain crops or for legumes having more than a single period of growth.

To prepare these soils for cropping, it is necessary to get out the excess of moisture, to admit the air with its warming and oxidizing power, to free the soil from substances injurious to crops, and to apply such amendments as will promote the availability of the nitrogen held in an inert condition by these soils and to add such fertilizing substances as they lack.

The cost of preparation of these lands by drainage and by the application of amendments and fertilizers is too great, in most instances, to render economical the use of these lands for crops that are now produced by extensive methods of farming. Where, however, the transportation facilities, nearness to market, and labor conditions make possible the growing intensively of onions or celery, it is well worth while considering whether or not the peat beds in such localities have drainage relations as will make their drainage possible without a too great expenditure, so that they may be fitted for the production of these crops.

It is not my purpose in this brief paper to describe fully the several methods which have been found useful in preparing such lands for cultivation. Several of the more important principles which govern will, however, be suggested. The first step is drainage and the

method most generally followed as to drain by ditching with or without the use of a subordinate system of tile drains. The water relations of these soils suggest and the extensive experience of German farmers in the management of the moor lands which form so important a portion of the area of northern Germany, have proven that the drainage of cumulose soils require plans different from those required in the case of mineral soils. In general, the water-table should not be more than twenty to twenty-eight inches below the surface and, where tile drains are used, the lateral ditches may be spaced so as to have an interval of sixty or ninety feet; and it is particularly important that the ditches be provided with dams, so that the drainage water may be dammed back to make it possible to hold the water in the soil during dry seasons. Irrigation systems also have been found especially advantageous for these lands in such seasons. Many of the peat beds of Pennsylvania are so situated that their drainage can be accomplished quite simply. There are others however, whose water level is determined by that of a large open body of water near whose outlet the peat bed is located. In the latter case they do not promise convenient control of the water relations, except where the peat beds lie at a level considerably above that of the lake.

As the water is drained away, the air enters these lands and begins very promptly their improvement by its oxidation process. A year or more is, however, often required to promote sufficiently the conversion of these soils by oxidation to fit them for cropping.

The process of oxidation is not in all cases productive of entirely beneficial changes in the land. This is particularly the case where the latter contains, in considerable quantities, iron pyrites, bisulphate of iron, for when pyrites are brought into contact with air, they oxidize and form sulphuric acid and oxyhydrates of iron. In lands still holding sulphuric acid, it works marked injury to crops started upon the soil and the removal of this acid by drainage is very slow. It will be recalled that these lands hold relatively small amounts of mineral matter such as might combine with the sulphuric acid to form harmless compounds.

The general method of remedying this defect is the addition of lime or of carbonate of lime. The range of recorded experience in the application of lime to these soils is too small to warrant the formulation of any rules as to the quantities in which they should be applied; in general, however, the dressings are relatively abundant. The lime not only neutralizes the sulphuric acid and decomposes any sulphate present in harmful compounds, but, also like the air, changes the character and proportions of the lower organisms living in these soils and working over their materials. Some cultivators have found that the ashes left by the burning of the weeds and other waste growths upon the surface of the land, yielded sufficient alkaline material to make possible the growing of satisfactory crops on peat beds without the use of lime or of similar alkaline amendment during the first year. In such cases, the burning was conducted in the early spring while the soil was sufficiently wet to prevent the fire from extending downward into the peat bed and thus destroying it and liberating a large amount of available nitrogen.

It has already been pointed out that the plants from whose decay these peat beds are formed, are usually poor in phosphoric acid and potash, particularly the latter. It is readily understood, there-

fore, that those who have attempted to crop these cumulose soils after treating them with lime alone have often obtained unsatisfactory yields. Economic returns should not be expected, except where liberal dressings of rock and potash, rich in the latter element, are employed. The fertilizers need not, however, be expensive in proportion to their concentration in plant food for the reason that nitrogen, by far the most expensive plant food, is little if at all required on these lands.

No attempt will be made to describe in this place the detailed methods useful in the culture of onions and celery upon these lands. Various experiment stations have published numerous bulletins treating more or less directly upon these subjects and those interested will de well to obtain the Farmers' Bulletins and other publications treating of them.

There is another way in which muck is made useful on a farm which deserves brief consideration at this point. It has already been noted that the upper, looser layers of the peat are very spongy and can, therefore, hold larger quantities of liquid without dripping, and it has been pointed out also that they contain important amounts of nitrogen which though not available in their original state, can, if the proper fermentations be set up, be converted into plant food. These qualities have led many farmers to expend the labor necessary to dig out piles of the muck allow them to stand where they can drain and undergo the changes brought through the winter's freezing and the summer's heating, and have then applied the material as a top dressing or as a material to be mixed with the soil. The results of these operations have not indicated that the treatments of drainage, freezing, and oxidation have been sufficiently effective to make the bed thus prepared a highly useful soil constituent. When, however, this porous material is put into the drops of a stable, or partly mixed with the rotting manure heap in the barnyard, it becomes impregnated with the stable or barnyard liquor and sets up a much more rapid fermentation. I am unable to recite chemical evidences showing the substances into which the nitrogenous materials of the peat are changed by the fermentations set up under these conditions, nor to give the results of exact vegetation experiments with the fermented materials, but the general judgment is that after such fermentation the peat contributes a very considerable proportion of nitrogen to the plant food supply of the soil upon which it is used as a dressing. It is, however, of great value as a bedding material. The sphagnum moss gathered by cheap labor in German swamps and imported into our seaboard cities under the name of "German moss," has been quite largely used for bedding horses in city stables. It shows a very large capacity to absorb stable liquor, does not undergo disagreeable fermentations, and has considerable durability. It does not, however, keep the animals in so clean a condition as good rye or wheat straw. Certain of its constituents seem to retard the amoniacal fermentation. On the other hand, more highly decomposed muck turns, when used in the drops, into a heavy black mud, hard to handle, and not most conducive to stable cleanliness. In my introductory words I referred to the fact that these peat bed materials are coming to increasing technical use. At the present writing, it is possible to make only a brief reference to some of these uses. The moss, picked and dried, is being employed as a packing material in the

place of excelsior, as a filler for mattresses, and also as a raw material for paper manufacture. Another use to which the more compact materials of peat beds are being put is that of a fuel. It is well known that, for centuries, the Irish peasant has warmed his cottage by use of the heavy turf or *sods* of peat cut from some nearby bog. The present experiments have the object of putting this fuel into more compact, convenient, and durable form for transport and consumption, and very interesting results have been obtained by the making of briquettes of peat, with or without the use of combustible bindings. Most of the acetic acid used in chemical manufacturing operations is now produced by the distillation of wood whose chief constituent is cellulose. Distillation methods have also been applied to peat with more or less promising results.

The last of these technical uses to which I would now refer is the use of dry peat in the manufacture of commercial fertilizers. For this purpose thoroughly decomposed peat is used. It is prepared by drainage, drying, and granulation by a milling process. Thus prepared it contains in some cases as much as 3 per cent. of nitrogen. Its use in fertilizers might, in view of the fact that the nitrogen as it is in peat is practically useless to plants, be regarded as undoubtedly fraudulent in so far as the nitrogen contained in the peat enters into the sum total which the fertilizer guaranty requires shall be present in the mixed fertilizer. In other words, the case is not simply that of an inert filler having no fertilizer constituents which would appear upon the usual methods of analysis and which is employed solely as a make-weight in the manufacture of low grade fertilizers. The fertilizer manufacturers claim, however, that the use of this or some other organic material in the base goods from which the various fertilizer mixtures are made by the addition of one or more of the fertilizer salts is desirable, because it serves as a "conditioner," that is, a material which keeps the goods in excellent drilling condition even when they have been exposed in storage to extremes of dampness or dryness; whereas, without some such material the fertilizer tends either to become moist if stored in damp places, or to dry and harden into lumps if stored in places too dry. No farmer who has applied fertilizer by means of a drill or by means of a broadcaster, will question the importance of a good physical condition in a fertilizer, but I am confident that, on the other hand, he will not be satisfied to pay for peat nitrogen at nitrate, ammonia, or tankage nitrogen prices, unless he be satisfied that a good physical condition cannot be secured at a less price. It has certainly not been demonstrated that the use of this material is necessary to the maintenance of a good drilling condition in a fertilizer. There are unfortunately no data available whereby the quantity of nitrogen contributed by peat and similar materials can be ascertained from the examination of a finished fertilizer. Indeed, there is yet lacking an entirely satisfactory test of its presence in any quantity. In the existing condition of knowledge we may, however, gain some slight satisfaction from the facts that peat is commonly introduced into fertilizer base by the wet mixing process and that, as Professor Haskins, of the Massachusetts Experiment Station has shown, peat nitrogen after exposure to the heat and acid of the wet mixing process becomes more highly soluble and has shown itself by vegetation

tests conducted in wire baskets in a very considerable measure more available to plants than when in its original raw state. The Pennsylvania Agricultural Experiment Station is at the present, under the writer's direction, conducting tests upon the effect of wet mixing on inert nitrogenous substances, including peat, with the hope of adding to our present knowledge upon this subject.

REPORT OF THE MICROSCOPIST AND HYGIENIST

By PROF. JAMES W. KELLOGG

A report of the work accomplished during the year must necessarily be confined more to microscopical examinations than to that which might possibly be designated to the duties of a hygienist, or the work which has to do with sanitary science and the preservation of health. Your specialist has only been able to devote study to microscopical work in connection with the examination of feeding stuffs made by the Bureau of Chemistry of the Department of Agriculture, whose duty it is to examine these commodities for their purity of composition. During the past year, we have been busily engaged in this line of work and are able to report that the samples examined were found to be as a whole greatly improved over those examined during the previous year.

The use of the microscope in investigations of this kind and in studying nature is one of the most interesting branches of science. The value of this instrument cannot be estimated, and the discoveries made by its use are too numerous and too wonderful to endeavor to describe here. The microscope has helped men of science to unlock the secret of nature, to look into another world, the microscopical world so to speak, and to discover new forms of life and small particles of matter which were never dreamed of before this valuable instrument was perfected and as widely used as it is today. All through the centuries men have unlocked nature's secrets one after another, first, by a very crude instrument and later by improved forms, until at the present time, the microscope is used in practically all branches of scientific research, and in the business of the commercial world.

It was known by the Greek and Roman philosophers before the time of Christ, that globes of crystal or lenses would focus the sun's rays to a single point. Seneca states that "letters though small and indistinct are seen enlarged and more distinct through a globe of glass filled with water." The ancient students, however, do not appear to have made use of this phenomenon as an aid to vision, as in the thirteenth century, medical writers seemed to be of the opinion that it was impossible to cure short-sightedness.

The first distinct advances in microscopy were made by the Arabian physician, Alhazen, in the eleventh century. Near the end of the thirteenth century, we learn that lenses were first used as a help to defective vision, for we are told that Salvino Armati, a Floren-

tine, first invented spectacles. At about the end of the sixteenth century, lenses were used as microscopes for the examination of objects too minute to be studied with the unaided eye. These lenses were, of course, very crude affairs and were only used singly. The microscopes which are in use today are known as compound microscopes and are made up of several lenses capable of magnifying an object several hundred times. The first instrument of this kind was invented about 1590, and Galileo perfected one in 1610. Since this period, every year has seen new improvements, and no up-to-date and well equipped laboratory is complete without a microscope. It has only been in recent years that this instrument has been made use of in the analysis of foods and feeding stuffs, and Pennsylvania was one of the first states to take up this line of investigation.

When the inspection of feeding stuffs was first commenced in our State, it would have been impossible to learn the true character of these products, if microscopical work had not been done. The analysis of a feeding stuff is of course of great importance, but it is also important that the source of protein, fat and carbrohydrates are found, and by a thorough examination of the feeding stuffs, we are able to determine the source and nature of the ingredients. It would seem to those unacquainted with the work that it would be difficult to determine the composition of a mixed feed which has been compounded of several ingredients, covered with molasses, dried and finely ground, but with the aid of a microscope, we are able to magnify each little particle or tissue in any feed to 400 times its actual size if necessary, and as occasion demands, and to tell just what cereal or by-products are used in the mixture.

Every cereal has a peculiar cell structure different from that of other cereals, and the starches of the many grains differ in their size and shape, and it is as easy for an expert to learn to know these different grades of wheat. There are twenty different kinds of starches which are in this way easily identified by the size and form of their grains.

The structure of the cell walls of a kernel of wheat grown this year would be the same as that of one grown in Egypt two thousand years ago, and can be easily distinguished from the cell structure of rye, barely or oats. This may be illustrated by the fact that the side walls of the cell in the seed coat of a kernel of wheat looks under the microscope like a string of beeds, while those found in the barely are smooth edged and sinuous, and the cell walls of other cereals are different from these. The starches of the wheat are round and flat, while those of the potato are three or four times as large and shaped like an oyster shell. The structure of the cell walls of the corn cob, rice hulls, peanut shucks and the weed seeds are very characteristic and markedly different from each other when magnified about four hundred times, and are easily identified by the practiced eye.

A few years ago, a large number of feeding stuffs were sold in Pennsylvania which contained rice hulls in a finely ground condition, ranging from ten to twenty-five per cent. Other by-products were used which caused the protein and fat to meet the guarantees, but, by the aid of the microscope this form of adulteration was detected, and as a result during the year just closed, this material was not found to be present in any feeding stuffs sold in our State. By our thus being able to tell of just what the products are composed which are

offered for sale as a food for our citizens, or as a feed for their stock, we are able to prevent fraud and deception and to keep down the sale of such articles which are not worthy of being produced or sold.

The stalks, tissues and fibers of plants, the cell structure of woods and barks, hair, wool, fruits and their seeds and hundreds of other products of the vegetable and animal world have special characteristics of structure known to the trained microscopist. By reason, therefore, of his special knowledge, he is called upon to tell whether or not a product sold as wheat middlings contains 26 per cent. of ground corn cobs, if the pepper which he is using contains vegetable ivory, cocoa shells or some inferior bean, and whether or not the many spices are as pure as advertised. He is asked to tell us the composition of paper and to state the proportion of linen rag or wood pulp used therein. By a knowledge of the structure of the vegetable and animal fibers, the composition of fabrics can readily be told. Thus, it will be seen that the microscopical investigations which have been made and which are continually going on are of great value, and this work in conjunction with chemical analysis has made it possible to keep the food products sold in our Commonwealth up to a high standard.

The work of a hygienist should be devoted to that branch of sanitary science which has to do with the keeping of the communities in which we live in a sanitary and healthful condition. Work of this nature covers a wide range of subjects, and it is unnecessary to state its value. For several years large and small cities have devoted a great deal of time and money to this line of work, and the work done by our present State Department of Health is well known throughout the land. When investigations are made as to the sanitary conditions of some places of abode, it is almost amazing to learn how little attention is paid to this work. Laws have been passed in nearly all the states of our country, regulating the sale of food products. In many of our cities we have milk inspection and of course food inspection, but very few cities or communities have what might be called sanitary inspection, which, to my mind, is as important and possibly more important than the analysis or examination of foods. This might be illustrated by conditions which can in many instances be verified by visiting a restaurant to obtain a meal. The food served there might be of the best quality and may have been in a cleanly condition, but, on the other hand, it often happens that the sanitary conditions of the kitchen and those serving us are such that would make the spread of disease or sickness possible. I personally have been an observer of these conditions, possibly noticing them more than some, by reason of being very much interested in this line of work.

I have visited cafes, restaurants and places where food is sold and have noticed that the sanitary conditions and the methods of handling food were not as they should be. Many illustrations might be given but these conditions are too well known to the careful observer to bear repetition here.

The State of North Dakota enacted a law of 1909, known as the Sanitary Inspection Law, which, it seems to me, is one of the most important laws which has to do with the preserving of the public health which has been passed for some time in any state. This act provides for the sanitation of bakeries, canneries, packing houses,

slaughter houses, dairies, creameries, and every place and vehicle in which food for men is placed for transportation or sold. It also provides for the proper and cleanly condition of any dispensary, hotel or eating house where food is sold. It makes it possible for officers in enforcing this law to visit all such places and see that the plumbing and drainage are proper and that the places are kept clean, properly lighted, etc. It also provides for protection from flies, dust and dirt, and that operatives, employes, clerks and any persons who handle foods in any way, shall be cleanly, and to be free from any disease, a number of which are enumerated.

I have been told by the official who has this law in charge that it has worked remarkably well and has been the result of causing several ice cream dispensaries and small restaurants to practically close down until the sanitary conditions were such as to warrant patronage. The Health Department of our State would of course control this matter to some extent, but I thoroughly believe we should have a strictly sanitary law which would correct these evils and prevent such unsanitary conditions as are too often observed in places where food for human consumption is offered for sale.

REPORT OF THE POMOLOGIST

By GABRIEL HIESTER, *Harrisburg, Pa.*

We are at last making some progress in the science of growing fruit. The orchard experiments that have been running four years under the supervision of Prof. Stewart of the State Experiment Station are beginning to show results. For instance, it has been found that nitrogen applied in the form of nitrate of soda after the fruit has formed, in June, increases the size of the fruit, as well as the growth of the tree, but at the same time it reduces the color of red apples. This loss of color in Prof. Stewart's opinion is caused by delayed ripening. Again, it has been found by practical fruit growers that fungicidal sprays applied under proper weather conditions will cause the foliage to remain fresh and green until nipped by the frost, and when the leaves are kept in a healthy condition late in the fall fruit is delayed in ripening. This may mean a great deal to the orchardists of southern Pennsylvania, especially to the region known as the York Imperial belt, namely, that section of the Blue Ridge extending from the Maryland line to the upper end of Dauphin county.

The Baldwin apple is generally recognized as the best business apple; it is the standard by which other varieties are measured—as to vigor of tree and hardiness, quality of fruit and the price it will bring in the general market. There are large areas of ideal Baldwin soil in this York Imperial belt, and many thousand Baldwin trees of bearing age. The variety, however, has one serious defect, owing to climatic conditions the fruit drops early in the fall, and those remaining on the trees do not keep well. For this reason

several less desirable kinds, which will hang on the tree are being recommended for planting in this district.

If, by the judicious use of nitrogen as a fertilizer and Bordeaux or some other fungicide as a summer spray, we can hold the fruit of this desirable variety on the tree until the first week of October, the Baldwin trees already growing in the orchards will be made profitable. More Baldwin trees will be planted and King and Spy will be added to the list—for with very slight variation of soil conditions the two latter will succeed wherever Baldwin does. We know that York Imperial, Grimes' Golden and Staymans' Winesap develop their highest qualities in this region. If we can add Baldwin, Spy and King we will have six splendid varieties to select from. It seems to me the York Imperial belt should very soon develop into the most famous apple orchard in the world.

If the future observations of Prof. Stewart shall confirm the impression already formed, namely, that nitrogen properly applied as a fertilizer will delay the ripening of apples, and if that with the aid of a proper fungicide as a summer spray, will keep them on the tree in southern Pennsylvania until mid October, by which time the sun will have painted them the proper color, this one discovery will be worth a hundredfold more than the entire cost of the experiment.

Another fact has been brought out by these experiments: In the older orchards, especially those which had not in recent years been well cared for, nearly all the feeding roots were found to be outside the spread of the branches. Many of them extending forty feet and more from the trunk. It will be well for the owners of old orchards to bear this in mind and in their efforts to bring the trees back to profitable bearing, place their fertilizers where they will do the most good. When placed near the trunk they are of very little value, when placed under the outside branches they are partially available, but when scattered between the rows outside the branches the trees get the full benefit of them.

In my last report I expressed a hope that in the near future we might have an investigation started to ascertain the effect of different types of soil and subsoil on the several varieties of fruit, for the purpose of enabling us to plant the right tree in the right place. I am glad to be able to announce that in response to the urgent request of Dr. Hunt, Director of our Experiment Station, the Department at Washington detailed Mr. H. J. Wilder of the Bureau of Soils to work in Pennsylvania. The Department loaned Mr. Wilder to our Experiment Station for one year, and he has been at work in this State all summer. Mr. Wilder has made a good start. He secured and tabulated much useful information; he has done well for the time spent, but his work is only begun. Our people are only beginning to appreciate the value of it, therefore it seems to me that it would be a calamity to have this work stopped at the close of the year.

I would suggest that at the proper time this Board pass a strong resolution urging the Department at Washington to continue his leave of absence, and another asking our Experiment Station to continue this work, and also to continue the orchard experiments so ably conducted by Prof. Stewart; in both of these lines we have made a decided advance.

Experiments with various fungicides and insecticides as summer sprays have been conducted by Prof. Stewart at our Experiment Sta-

tion; by our Economic Zoologist; by the National Department at Washington and by the Experiment Stations of the several states. Nothing has yet been found that is in all respects and under all conditions better than Bordeaux and an Arsenate. It seems that under certain weather conditions they will all do more or less injury. It is up to our scientific men now to tell us under what weather conditions we should not spray with anything, and under what weather conditions we may use the several sprays which they have found effective.

The use of self-boiled lime-sulphur for the control of brown rot in the peach is gaining in popularity, and we hope that before another year has passed, we may have a formula for making it that will be certain in its effect on the fungus, and at the same time do no injury to the foliage.

The most hopeful sign of the times is the interest the young men are taking in horticulture as is shown by the number of students in the regular four years course in horticulture at State College, in the two years course and in the twelve weeks course, and the young farmers who attend the lectures on horticulture during farmers' week. These young men are not only learning how to grow fruit, they are carefully studying the art of grading and packing, and already are sending to the general market box apples and barrel apples, which for skillful, honest work will compare favorably with those from the famous orchards of the west. These young men are doing much toward establishing a reputation for Pennsylvania fruit. We all recognize the fact that the greatest need of the fruit industry in Pennsylvania is men properly trained for the work, and this need is being gradually supplied, with a number of Horticultural graduates going out from State College each year and hundreds of working farmers going to the college each year for a week's lecture course, with the Farmers' Institute bringing lecturers to their very doors, to tell them why they should do certain things, and the demonstrators of the State Department following up the institute to show them how to do it, the men are rapidly being trained for the work, and we are developing a class of fruit men in Pennsylvania equal to any that can be found in the most progressive fruit district of the country.

REPORT OF THE COMMITTEE ON LEGISLATION

We the Committee on Legislation beg to submit the following report and would respectfully recommend as follows:

1. That the real estate owners of Pennsylvania demand a just equalization of taxation in this State. We would reiterate that if personal and corporate property were taxed at the same average mill rate that real estate would be taxed, personal and corporate property would be required to pay forty-five million instead of twenty million. We further believe that a great help towards the equalization of taxation is found in the proposition of having the State pay the minimum salary of school teachers for the minimum

school term. To correct discriminations that exist against the farm and farm owners of Pennsylvania, we respectfully insist that the State either assume a larger proportion of the cost of the local government, or give the local governments authority to tax personal and corporate property in each unit of government. The local government of our State could be further relieved by appropriating a minimum sum per mile to counties and townships for road purposes equal to 100 per cent. of the cash road taxes paid each township. Let the State assume, with the aid of the National government, the entire construction of interstate and inter-county roads and maintain the same.

2. If we have not sufficient revenue for the advanced government of the State, an additional tax of one mill could be placed on all personal and corporate property with a small tax on the gross products of mines, oils and gas wells and similar enterprises. An increase license on automobiles would greatly assist in increased revenues, and such revenues received would greatly assist in increased revenues, and such revenues received should go specifically for road purposes.

3. We, your Legislative Committee, would suggest that some remedy be presented, or law enacted to regulate the improper use of public roads by teams and cutting them up and almost ruining our public roads through heavy hauling over them without paying any damages to townships, many times ruining the roads for miles. Permits should be taken out, through the Board of Supervisors, before using the roads for continuous heavy traffic. When a public road is almost entirely ruined, many times to the extent of several hundred dollars, some specific remedy should be prescribed by law.

4. We heartily endorse the Good Roads Movement that seems to have taken a new lease of life in our State. We highly appreciate the generous efforts of the Pennsylvania Railroad Company in furnishing an educational train to traverse the State from east to west in the hope of bringing out a more determined effort to construct permanent roads all over our great State. We recommend the election of a County Engineer of Public Roads, similar to that of a County Superintendent of Public Schools.

5. The purchase of the old toll roads of the State does not appeal to us as fair, inasmuch as many counties in the past have freed the toll roads and bridges at the expense of their own counties to the amount of many thousands of dollars.

6. We believe in the intelligent use of the King Drag for our public dirt roads. We would recommend a law compelling telephone companies to interchange messages.

7. We believe that our farmers are much interested in the passage of a law providing for a State Agricultural Fair. Too much cannot be done for agriculture, either by the appropriation of money or by the passage of new and effective laws.

8. We want a law compelling seed dealers to label seed bags either strictly pure, or as containing a percentage of inferior seeds. We are glad to say, however, that our worthy Secretary has now in course of preparation a bill fully covering this subject.

9. We recommend the Initiative and Referendum and Recall system as it is now practiced in Oregon.

10. We further recommend that an appropriation be made by the State to pay the deficiency to the different agricultural societies throughout the Commonwealth for premiums, in accordance with the provisions of a law which now allows each county in the State $1,000 for premiums on agricultural exhibits.

11. For the furtherance and increased spread of Agriculture and Agricultural Literature, we favor the proceedings of the State Board of Agriculture to be placed in the various public schools throughout the various counties of the State.

12. We disapprove of a law which inflicts a license fee for hunting game throughout the State.

13. The State Livestock Breeders' Association are doing valuable work in extending and spreading the thorough breeding of animals, greatly improving the different breeds of livestock throughout the Commonwealth of Pennsylvania.

14. The good work of our State College is apparent to us all, however, it is inadequately equipped for the accomplishment of telling work. The Poultry Department of the College is without buildings and equipment for carrying into telling effect the proper development that should be, along this important branch of agriculture. We would most earnestly recommend to the present Legislature that sufficient appropriation be made for such buildings as is so much needed for the proper carrying out of modern methods along all lines of new agriculture at State College.

15. We join in hearty endorsement of the rapid development of our State Horticultural Society and compliment the society upon their magnificent display of fruit as seen in the Johnston Hall of this city.

16. We fully recognize the efficient work of the Department of Agriculture and come with words of praise for the improvement of the new law regulating the manufacture and sale of Commercial Fertilizers. We would, however, recommend a more simplified method of computing the value of a ton of fertilizer by omitting much of the wording placed upon the outside of the sacks of fertilizer.

17. We heartily endorse the sentiments expressed by Governor John K. Tener before this body yesterday, namely: That roads should connect county seats, and run perpendicular to and not parallel with our railroads. That the State should have some well devised system of road making, and that all revenues be used to relieve local taxation.

18. For the further stimulation of agriculture, which is the foundation of all our material wealth and prosperity, we would recommend that agricultural societies, instituted for the spreading and development of agriculture, owning their own properties and holding annual fairs, be exempt from the burdens of taxation, as this would greatly assist and relieve pecuniary obligations.

19. In conclusion, we would, to the best of our ability, impress upon the farmers of Pennsylvania the necessity for increased vigilance in zealously guarding their profession from the attacks of the outside interests. We believe that the proper position of the agricultural industry cannot be secured until the farmers get together through their own organization and demand the passage of laws that are fair and the election of men to executive positions who are not biased in favor of the selfish interests which prey upon the people who produce.

We believe in improved methods in agriculture and know that the productiveness of our farms should be and must be increased; yet, we also feel that it is not by method that the farmer will come into his own as a producer and a real part of our social and business scheme, but, by legislation and the proper execution of well meant laws.

Respectfully submitted,

HOWARD G. McGOWAN, Chairman.
A. J. KAHLER,
S. S. BLYHOLDER,
E. B. DORSET.

TILE DRAINAGE

By T. E. MARTIN, *Syracuse, N. Y.*

We are realizing more and more every day that tile drainage is a very important factor in the successful pursuit of agriculture, and there is no doubt that where tile drainage is needed and is done it will soon repay more than its cost. Some people try to improve their farms in other ways. They will erect good buildings or in some way improve the farm. That is all well in its place, but just remember that buildings will not make a farm but a farm may make buildings, and if the soil is wet it will pay to drain it. Many dollars are spent for fertilizers and I know that if such money was spent in buying tile and putting them into the ground it would have paid much better. We are constantly looking for paying investments. Tile drainage is one way to invest money in such a way that it will pay sure and large dividends annually without the aid of an investment company watering the stock. Tiles abhor water.

I would just like to take up the soil for a few minutes. Soils are made up of innumerable small particles. These vary in size and shape and touch each other, more or less, according to the compactness of the soil. It is said by scientific men that soil particles vary in size from 4-100 of an inch to 2-10000 of an inch in diameter. (Blackboard illustrations used throughout.) If a soil is made up of very small particles there are more particles in a given quantity of soil, and of course, we have consequently more soil spaces. The smaller the soil spaces, the closer the particles lie together and the more resistance offered drainage and consequently more drought resisting. The coarser the soil particles the less resistance offered drainage and drought. Therefore, the soil is made up of spaces largely. These spaces are said to range from thirty-seven per cent. in coarse soils to sixty-five per cent. in fine soils. If we have fine soil particles we have more space in the soil and vise versa with coarse soils. Now these spaces in the soil perform several offices, three important ones. They provide for the drainage and removal of the water from the soil and aeration. Also, they provide for capillary attraction to be re-established—a triple mission being performed. Here is the sur-

face of the soil. Rains come and the soil is thoroughly saturated with water. If the soil is coarse or fine, the water table gradually lowers accordingly if an outlet is provided. Here is one tile drain and here is another over there. As the soil is saturated with water, it commences to pass off through the drains. The water table in the soil gradually lowers slower and slower until it gets near the grade line. The water directly over and around each drain is the first to flow away to the depth of the drainage system. If drains are placed three feet deep, they would not drain to that depth over here, midway, probably only two and a half feet deep. If we place the drainage system three feet deep we do not drain all the land to that depth but perhaps around two and a half feet. Something must be allowed for the flow of the water through the soil. Now as the water goes down and out we can see how effectually the drains work. It will dry up wet stagnant soil so that it will grow any ordinary crop. I want to clear up one point. As the water goes down—just remember it is only the surplus and free water that the tile drainage system removes from the soil. As the water goes to the drains, each small soil particle retains a little bit as film moisture. This amount of film water ranges from fifteen to twenty per cent. of all the water a soil will hold. This soil above the water table—the drain level, has retained by surface tension all the moisture it needs. As the water lowers down to this drain level the excess water flows away by gravity off through the drains and capillary attraction being re established brings the water from below this level up towards the surface. Drainage does not interfere with the sub-soil water below the drains. We have just as much water below the drains as we ever had whether soil is drained or undrained. Capillary attraction brings up the sub-soil water from unbelieveable depths. The finer the soil particles, the smaller the spaces which form tiny like hair tubes throughout the soil. They form channels, vertically, horizontally and diagonally in every direction. Now capillary attraction is the force which brings the water from lower to higher levels just as soil rises in and by the lamp wick to the flame. The water passes out of the soil by and through these same channels according to gravitation along the lines of least resistance. Water leaves the soil in obedience to the laws of gravitation. Drains have no magical power to draw or extract water from the soil. A cubic foot of water weighs 62½ lbs., and it is easy to see how water is compelled drainward. Here is a cubic foot of water weighing 62½ lbs., and another right here on top of same. It is easy to figure out the pressure on each 144 square inches of area. But the soil sort of dams up, stops, holds back the flow of water through the soil, so we do not get the full pressure. Here is a side view of the tile drain. The soil spaces nearest the tile joints are the first ones to flow into the tile. Next, the excess water from the soil flows into the empty spaces, then into the tile drain at the joints and not through the walls. The bulk of the water goes in a drain that way at the tile joints. It is too slow a process for it to ooze through the walls of the tile. Then the soil spaces nearest those emptied are the next to flow drainward. This flow of excess water drainward continues upward and laterally until an equilibrium is established throughout the soil. That is the way a tile drain relieves the soil of excess water.

Tile drainage is a permanent paying investment. I will now try to show you how we applied it. We had to do a good deal of drain-

age work upon our farm to get it in shape. We started in 1894 and we have 10 1-5 miles (3265 rods) on 57.85 acres of land. It has paid us many times over the cost—$2,500. In the year 1908 our potato sales from 18 acres reached $2,807.89, and the drainage system more than paid for itself that one year. Four tons of cured clover and forty-five bushels of wheat per acre are the other best yields. Right here at my left (indicating on blue print) was a large pond and here an open ditch and natural stream. It leaves our place at this point and goes across a neighbor's farm. All this work was done at our own expense and the distance 3750 feet. The work on this neighboring farm has cost several hundred dollars. That shows how we value tile drains. Not only this, but we have to annually clean this out at an expense ranging from $10.00 to $50.00. The fall is slight and consequently the water flowing there deposits sediment which must be shoveled out later.

LAYING OUT SYSTEM

Suppose we had a rectangular field and wanted to drain it. If a valley passed down the centre of that and the slope of ground was at right angles to the valley. The proper way to drain it would be to put the main through there, the lowest places, and the laterals placed at right angles—straight up the slope. Or if the field had a slope, say angling to this low place down through the centre, the side drains ought to be placed like that at an angle of 45 degrees. (Illustrated on blackboard.) That would be the proper way to lay out the system. Run the drain straight up and down the slope, so each lateral takes water equally from either side. Drains running diagonally up a hillside take water principally from the upper side—an intercepting drain—half a drain giving only 50 per cent. efficiency where 100 per cent. is obtainable. Good drainage consists of parallel drains of good length and depth and so placed that the drainage reaches laterally from drain to drain and on time.

REPORT OF THE COMMITTEE ON RESOLUTIONS

To the Pennsylvania State Board of Agriculture:

We your Committee on Resolutions beg leave to offer the following report. We have studied the Resolutions submitted to us and report the following as meeting our approval:

RESOLVED, That we recommend to the General Assembly of our State, now in session, the passage of an act providing that fertilizer manufacturers shall, in placing their guaranteed analysis upon the packages containing their goods, make no statement of equivalents or any other matter than the simple statement now required by law.

Appreciating the valuable services of Mr. H. J. Wilder of the Bureau of Soils of the National Department of Agriculture, we would respectively urge the Federal Department of Agriculture to continue

his services in Pennsylvania as we believe the time is ripe for great activity along the lines of soil investigation and its application to our various agricultural interests.

We would further ask that provisions be made for the further development of the fruit industry of the State as conducted by Prof. J. P. Stewart of State College.

We recommend for the Department of Agriculture such increased support from the State as the increasing work demands for its successful prosecution.

We heartily indorse the movement to establish in our State an Agricultural Fair worthy of our Commonwealth.

We recommend that the expenses of the meetings of this State Board of Agriculture be provided for as usual.

We appreciate the work of the Department of Economic Zoologist and recommend a liberal provision for the prosecution of its work.

We are in hearty accord with the movement to improve our public roads. We believe that State Roads should be built and kept in repair by the State, and that liberal provision be made to improve our Township roads.

Recognizing the great work of the Pennsylvania State College School of Agriculture and its greatly increased needs on account of the wonderful increase in the number of students, we most respectfully ask that appropriations be made for its support commensurate with its needs.

WHEREAS we believe that there never was a time in the history of our Commonwealth in which the importance of extended knowledge relating to successful agriculture was so fully realized as is the case at the present time, and Whereas, the prosperity of our State depends more upon the development of its agriculture than upon any other industry in which her people are engaged, therefore,

RESOLVED, That we recommend to the General Assembly now in session, an appropriation to the Department of Agriculture of one hundred and fifty thousand dollars, for the two years beginning June 1, 1911, to be devoted to demonstration and agricultural work, as the Secretary of Agriculture shall direct.

WHEREAS this Board, in the discharge of its official duty is brought into close touch with the Department of Agriculture, so as to be able to judge of the efficiency of the efforts put forth for advancing the agricultural interests of the Commonwealth and the enforcement of the laws enacted to secure this end

WHEREAS, we regard a proper administration of the affairs of the Department of inestimable value to the farmers of the State, and

WHEREAS, we regard the Farmers' Institute as occupying a very important place among the educational agencies employed for the advancement of Agriculture, therefore, be it

RESOLVED, That we take pleasure in recording our appreciation of the valuable services rendered to the Commonwealth by the present Secretary of Agriculture and his efficient Deputy who has charge of the Institute work, and believing that the best interests of Agriculture would be subserved by the continuance of their administration, we would respectfully recommend their reappointment to the places they now occupy.

F. D. KERRICK, Chairman.
S. SHAFFER,
J. A. HERR.

LIST OF OFFICERS OF THE PENNSYLVANIA DAIRY UNION AND PENNSYLVANIA BREEDERS' ASSOCIATION FOR THE YEAR 1911, WITH ADDRESSES DELIVERED AND PAPERS READ AT THE JOINT MEETING OF SAID ASSOCIATIONS, HELD AT HARRISBURG, JANUARY 26 AND 27, 1911

PENNSYLVANIA DAIRY UNION

OFFICERS FOR 1911

PRESIDENT

H. M. STOKES

VICE PRESIDENT

M. F. PHILLIPS

SECRETARY

PROF. H. E. VAN NORMAN, State College

TREASURER

W. D. MARSHALL, Lyndell

DIRECTORS

A. B. HUEY

R. J. WELD

D. R. STEPHENS

GEO. G. PAXTON

HENRY WOOLMAN

PENNSYLVANIA LIVESTOCK BREEDERS' ASSOCIATION

OFFICERS FOR 1911

PRESIDENT

W. C. NORTON, Waymart

VICE PRESIDENTS

DR. C. J. MARSHALL, Harrisburg

M. P. SHOEMAKER, Greensburg

SECRETARY

E. S. BAYARD, Pittsburg

TREASURER

J. F. LANTZ, West Chester

TRANSPORTATION

T. D. HARMAN

D. CHESTER MORRIS

F. W. LEOIS

JOHN W. OAKEY

M. E. HEBER

W. C. BLACK

STATE FAIR

W. W. BLAKE ARKCOLL

E. S. BAYARD

JAMES BLAIR

JOE JENDERSON

DR. C. W. GAY

HON. VANCE McCORMICK

JAMES E. DODGE

MICHIGAN METHODS OF LIVESTOCK IMPROVEMENT BY A SYSTEM OF UP-GRADING

By W. F. RAVEN, *East Lansing Michigan.*

Michigan occupies a unique position in the galaxy of states in regard to its livestock industry, and some interesting features are presented in a brief review of the history of the development of that industry in the State. It has not been as rapid as in some of the states to the westward which went into the livestock business a few decades later, and which have now far outstripped us in the number of cattle. But the natural conditions, as the pioneer found them in Michigan, were not suited to the rapid development of the

livestock business. He had to produce the proper conditions. The first settlers found nearly all the surface of Michigan covered with heavy timber. As in all forest regions, the forage of the State was scant in quantity and lacking in nutrition for livestock.

The land had to be cleared before forage and fodder crops could be produced. As in all timbered sections, the settler had no desire to own more cattle than were required to supply the immediate needs of his family; he was loath to feed livestock the cereals which were produced on lands requiring so much labor in the clearing and cultivation. During the early history of the state the energies of the farmer were diverted to other lines of work than livestock production. In general, we find in the history of any new country, that far more attention is given to crop production, for a long interval, than to animal production. This has been particularly true of the Eastern and Central states, while the reverse has been true of the Far West. The rich virgin soil responds freely at first, yielding prolific crops of a variety of cereals possessed of high commercial value. Finally, however, as the land becomes less and less productive, the farmer begins to turn his attention to livestock production. Michigan reached its zenith in the production of wheat which was the cash crop (in 1884-1885) in the southern four tiers of counties and the yields of that cereal began to lessen the state over. A small minority of the settlers had brought with them cattle, and from the first had kept and bred improved livestock. With wheat, the money crop, lessening in yield, the opening of the newer Western lands decreased crop values. On the other hand, smuts, ruts, blights, and insect pests of various kinds began to appear, materially affecting both the quantity and quality of the crops produced. These conditions demanded the keeping of more livestock on the farms in order to enrich and utilize to better advantages those crops low in value in the raw state, they had to be manufactured into meat, milk and wool and thus many were led into some line of animal production.

I believe, at this period, (1884-1885) a majority of the farmers of Michigan began growing more livestock. There were a few places in the state where dairying had been carried on from the earliest settlement, (notably in Lenawee County). The southern portion of the state had in many instances good flocks of the merino and grade merino sheep and small herds of good cattle. In the first attempts to improve the cattle nearly all were of the beef type. This continued until the low price of beef compelled other than beef sires to be used. The farmers then turned their attention to dairying and began to improve their cattle by the use of pure-bred sires on the grade beef cows, (principally grade shorthorns). This system continued until the Spanish-American War, when beef rose in price until there was a good profit in growing it. Many that had been using dairy sires, changed to beef sires and bred the progeny of the dairy sire to the beef sire. The indiscriminate admixture of the blood of the various breeds has been one of the most direct causes of the production of inferior stocks. This has not been restricted to the breeds within the beef and dairy classes, but includes admixture of the blood of the two classes.

Another potent force tending toward the production of inferior cattle in Michigan is found in the too prevalent use of the grade and

scrub sire and the saving of calves, from bulls, bred to females for no other purpose than to freshen them again. The lack of good breeding among our cattle today is not due to the lack of the introduction of good blood at an early date. Shorthorns were brought into Michigan in 1843, Galloways in 1854, Herefords in 1864, Aberdeen Angus in 1884, Holsteins and Jerseys were also introduced at comparatively early dates. The records of Michigan Fair Associations from the time of the organization of the State Fair in 1849 would seem to indicate that an unusual activity in pedigreed livestock breeding was manifested in the earlier days, but this seems to have been confined to the so-called breeders.

The initial step in livestock breeding for improvement confronting us to-day is an exceedingly simple one. We do not need to undertake the establishment of new breeds, as there are plenty now in existence to choose from, which judiciously chosen will respond favorably to the conditions to which they are adapted. The first step in line of livestock improvement must come from the cessation of the practice of the admixing of the blood of various breeds and of using grade and scrub sires.

It would seem highly desirable that some form of co-operation in breeding methods should be established by communities, such for instance as the joint ownership and use of males by several parties rather than one. One cannot conceive of any logical reason why several men in a community could not form a co-partnership in the ownership and use of good sires. If such a plan could be followed the good influence of superior sires would become more far-reaching and fewer males in all would be needed than in the case of individual ownership.

Dean Shaw of the Michigan Agricultural College, believing that some form of co-operation in the ownership and use of pedigreed sires could be made satisfactory to the members of such an Association, submitted a recommendation to the State Board of Agriculture in December, 1907, urging the necessity for immediate action on the part of the College toward the development of co-operative organizations among the breeders and farmers of the State, designed to stimulate livestock improvement. This recommendation was accepted, adopted and the Agricultural Department authorized to undertake the work. In the organization of breeders associations in Michigan five chief aims are sought:

1. The improvement of the farmer himself, not only as a raiser of stock, but as a tiller of the soil, a business man, a citizen and a man.

2. The improvement of the flocks and herds of the state in their productivity and uniformity. Productive ability is being increased by the continued use of prepotent pure bred sires. By adopting a single breed for an entire locality, buyers are attracted and a local market created.

3. The principle and spirit of co-operation is fostered by co-operating in the purchase and use of breeding stock, the farmer learns to act in unison with his fellows and is able upon occasion, to extend the same principle into other fields.

4. The farmer is trained in business organization and conduct. Rural communities are conservative, even to a fault, and agriculture is seriously crippled by the lack of business methods and business system.

5. The improvement of the grade of livestock kept renders possible the further increase of capital upon a given area, and is one more factor in increasing the possible profits from the farm.

Thus far in Michigan, with two exceptions, the work has been confined to cattle and the first steps were taken among the dairymen, as it was possible to reach this class easiest through the creamery, condensary and cheese factory organizations and patron lists. The attention of the stockman and farmer was directed to the plan through the co-operation of the State Press and the Field Agent has been working in those districts only, in which his services were requested by the people. Before taking up the work in person in a given field, copies of the following introductory letter were sent to the patrons of the creamery, condensary, cheese factory or stockmen and farmers of the locality, viz:

"Dear Sir: The Agriculture Department of the Michigan Agricultural College has been authorized by the State Board of Agriculture to undertake special work in this State, endeavoring to stimulate the improvement of horses, cattle, sheep and swine. The proposed plan embodies a vigorous effort to induce farmers and stockmen to procure and use pedigreed sires rather than grades and scrubs. This plan is not only to advocate the individual ownership of good sires, as far as possible, but also to promote the establishment of associations for the joint ownership of males. It will be the duty of the Field Agent in charge to present a practical method of livestock improvement to individuals and gatherings of farmers and breeders.

As far as possible he will furnish information relative to the description, characteristics and adaptability of the various breeds. He will also lend assistance personally in the organization of associations for the joint ownership of sires and the promotion of improved breeding. Through the agency of the State Livestock Breeders' Association, lists of breeders with pure bred bulls for sale can also be furnished. If you are personally interested in livestock improvement and are willing to assist in interesting the people of your community, the services of the field agent can be secured without cost to you or the people you may succeed in interesting. Details of work will be given on request.

Yours very truly,
Field Agent in Charge."

When requests are received, the Field Agent calls upon the individual stock owner, looks over his animals, presents the co-operative plan of breeding to each man personally and secures data relative to the following direct question, viz: (1) How many cows do you own? (2) What breed or combination of breeds are they? (3) What were they bred to last year? (4) If you were to conclude to breed them to pure-bred sires continuously, which breed would you prefer? Where the owners of eighty or more cows have signified a preference for some one breed, the Field Agent then endeavors to induce the owners of forty or more cows to adopt the same breed, thus securing sufficient for an association of three groups. The individuals are then invited to meet at some suitable place to discuss the proposition from every view point.

When the owners of one hundred and twenty common cows decide upon some particular breed from which to select males for improvement, then an association may be formed. This particular form of organization containing one hundred and twenty cows is divided into three groups of forty cows each, with one bull for each group. There may be from two or three to seven or eight men in each group, depending upon the size of the herds, or there may be more groups in the association depending upon the willingness of the people of the community.

Each member joining an association is required to sign the following agreement, viz:

"We, the undersigned, desiring to organize a bull association do hereby promise to pay equal sums of money on or before..... for which we agree to take equal shares of stock in the aforesaid association when organized. This association is organized for the purchase of three or more registered.....bulls, provided three groups of forty cows each can be secured. The understanding is that these bulls are to be owned in common and changed from group to group every two years, thus providing service for six years. In case of the three-group association at the end of two years to avoid in-and-in breeding, the bulls are changed from one group to another and the same thing is done at the end of four years. In this way, barring accident, or loss of bulls by death, the association is provided with registered males for a period of six years at an initial cost of from $10.00 to $40.00 per member. The owner within each forty cow group should be somewhat closely located, but this is not true of the groups, which may be several or more miles apart, their only concern being an occasional business meeting and the exchange of sires every two years."

This plan has been put in operation in over thirty places in Michigan and is working successfully for the improvement of Michigan livestock. Under this plan there was this year between six and seven thousand common and grade cows bred to pure bred sires. This plan has many things to recommend it to the farmer who wishes to improve his livestock: (1) The low initial cost. (2) The advantage of always having a pure-bred sire available for service. (3) The use of mature sires. (4) Associations will buy better sires than the average individual. (5) When whole communities are interested in one line of breeding it makes a market for their surplus cattle, because they are grown in sufficient quantities to attract buyers.

In conclusion, gentlemen, the work done in Michigan has not been done in the thickly populated places in the southern part of the state. Most of the work has been in the sparsely settled sections, among the stump lands just as the lumberman left them, where the settler is making his home. Some of you perhaps know that in Michigan we have several hundred thousand acres of good hard-wood land, and the settlers from Pennsylvania, Ohio, Illinois and Indiana are coming to these places and making homes there, and it is among these people that that work or most of it is being done.

MR. HARMAN: How would you go about it in a thickly settled community where there are old established breeds and that prejudice to be overcome?

MR. RAVEN: That is one of the worst troubles we have to overcome—breed prejudice. I have now on my list twelve or fourteen associations where they are all ready to organize could they agree on the breed of cattle, and it is necessary for us to hold meetings—sometimes I have held four to five meetings to try to overcome breed prejudice and educate them to a solution corresponding to surrounding conditions. Greater advancement has been made in our country where they have no breed prejudice. But we are overcoming that. For instance, we have old Van Buren county organization in the breeders' association; we also have a Holstein association that takes in Lenawee county; we have an island in the Detroit River, Graselle, and every man on the island except one breeds Guernseys. We try to educate to overcome this breed prejudice. I want to go at them this way: "Gentlemen, don't you think it would be right and proper and a money-maker to breed Jersey cattle at this point? If this man can make money the whole of you can make money." Howell is one place in America where more Holstein breeders get their mail than any other place. Twenty-five or six receive mail at Howell.

A Member: Who selects the sires?

MR. RAVEN: All of these associations are incorporated for a period of thirty years. It is not a one-day affair or one-year affair and the men that go into these associations intend to breed one kind of cattle continuously, so each association is governed by a board of five directors who do all the business. In some of these associations the College has to assist them in the selection of sires, and in most places we have some young men who know nothing about cattle and somebody has got to be educated along breeding lines, and these are the men we attempt to educate. We say go out and buy the sires and get the best information you can and use your own judgment. We try not to interfere with the business proceedings in any way, shape or manner. They have the right to buy whatever sires they want; they can pay whatever price they want. Sometimes it is a good thing to have them buy poor sires first and then they know where they lost out and are more careful. Each association selects its sires, buying where they like. We furnish them with a list of all the breeders of the State breeding that kind of cattle.

A Member: Have you noticed any tendency to buy better bulls since the organization?

MR. RAVEN: Yes; associations buy better bulls. While my work is along association lines, I have placed more bulls outside of associations than inside of the associations, because a great many men refuse to join associations and will breed all the same. At one place I organized a Guernsey association and placed five bulls in the association. There were seven bulls bought by individuals outside, so I had two more to my credit outside the association than inside.

MR. HARMAN: What about the productiveness? What have you noticed in regard to the increase in produce, the marketable products since the organization of these breeding associations?

A Member: Who keeps these bulls?

MR. RAVEN: I expected that question. In every association group there is one man centrally located as to his particular group who keeps the bull for hire. There is a service fee for each member, that goes to paying for the keep of this sire. For instance, it costs $40 to keep the bull a year, each of the forty members in the group pays one dollar service fee towards the keep of the sire and he pays that to the caretaker of the sire when the service is had. The caretaker furnishes the secretary with the name and the date and the number of the cow bred. That is part of the record.

MR. WELD: Do you succeed in getting the members of the association to take hold of the work of record keeping or weighing and testing of the individual cows in their several herds or is that done by the association?

MR. RAVEN: That is done by the cow testing associations.

MR. WELD: All together?

MR. RAVEN: Yes. We have two associations; one the cow testing association and the other the community breeding association. In all cases it takes more cows to form a cow testing association than a community breeding association, and in all cases where there is a cow testing association in a district in which a breeders association is located the larger part of the members of the breeders association will become members of the cow testing association. They keep their records more easily. It takes twenty-six herds of cows, no matter what number, to organize a cow testing association, so that the tester can visit each herd once a month. In some associations, our breeders' association and the cow testing association is one and the same thing; every member of one is a member of the other; but in other places it is not so.

A Member: Do you have to be a member of this association to have the good of service in that bull?

MR. RAVEN: No, sir; you do not; but if you are not you have to pay two or three times the fee for service above the others.

A Member: Wouldn't that be a good way to get these outside people interested in these breeding associations?

MR. RAVEN: Yes, it would. The difficulty we find in Michigan—it may not be in Pennsylvania—but in Wisconsin, Minnesota and Michigan and Northern Ohio—that is, whenever a man is progressive in introducing a pure bred sire his neighbors will not use it; if they do use him they refuse to pay a service fee equivalent to his cost and he gets tired of using it. Just as sure as fate the next pure bred sire brought into that neighborhood is one of a different breed If I introduce a Shorthorn my neighbors will introduce a Holstein or some other breed. In these associations wherever they do not have cows sufficient for the bull they will allow outside persons to buy his services, although they have to pay two or three times the cost to the members of the association; but it is a good way to get the improvement of stock. And I find this in our oldest association at Blissville, that was organized four years ago in March, I find in that community that nearly all of the people, with two or three exceptions,

are breeding Guernsey cattle. I think in a few years Blissville, Mich., will be noted for Guernseys as Howell, Mich., is for Holsteins, simply because they show the facts to me. They have been breeding upon the common stock and the farmers have got to buying pure-bred Guernsey sires and in many instances pure-bred females of the Guernsey breed.

We do more than that. We keep a record in the Department of Agriculture at College of every member's herd, of the officers of the association, and some member from the Department of Agriculture visits each of these associations once a year at their annual meeting; sometimes the President of the College; sometimes the Secretary of the College; but more often those directly engaged in the work, the head of the Dairy Department, the Beef Department or Dean of the Agriculture College, some member of the faculty visits these associations and hears the plans and methods they are using for improvement of livestock, and we keep record of these things. (Applause).

ADDRESS

By JOHN D. NICHOLS, *Cleveland, Ohio.*

Mr. Chairman, Ladies and Gentlemen: I fail to understand why your Chairman should have butted in on the discussion that was going on, as I assure you much more good could be gotten out of the discussion than you can get out of anything I may say to you.

I have been very much interested in the address and discussion following, and I can only voice the sentiments of the gentleman, that a breeding association is very valuable to all parties concerned. It is valuable to the members of the association; it is valuable to the community living around where the association exists; and it is valuable to the fellow who is looking around for a particular kind of stock that association is breeding. If you don't believe that, you start out and try to buy three, four or five carloads of cows of one particular form and have to drive from pillar to post, from Dan to Beersheba, to find the stock you want. You have to go through sections of the country which it has been my fortune to visit and you will find two or three Jersey herds and two or three Guernsey herds and two or three Holstein herds and you will find two or three Ayrshire herds; and you have to drive all around to buy a carload of one particular breed.

Another thing: There has been much said about the sire. I believe that the greatest mistake by the breeders of dairy cattle in this country to-day is in the selection of the sire that heads the herd. It has been said that the sire is half the herd. Sometimes I think it is about nine-eights, especially if you are going to raise them. I have a friend back home who was talking to me some years ago—one of the largest dairymen in Northwestern Ohio. He said: "I want to

show you a couple heifers I got;" and he took me to the stable and showed me two females four years of age, sired by a good sire at a cost of $4.50 fee for each animal, and the rest of the herd were bred to a sire at a cost of fifty cents and the result was that he would not have to talk long to get $125 apiece for those bred by the good sire and those bred at a cost of fifty cents each he would have to talk an ear off to get $6 for. Now that shows that that original investment was pretty well made.

The cow testing association has done wonders and I believe it is going to continue until it will revolutionize to a large degree the dairy business. I am a member of a cow testing association, while my herd is so far away from the home of the association that I have no benefit only in a general way. They have demonstrated with a cow testing association of twenty-six members that one of the members can produce milk with his herd at a cost of sixty-seven cents per hundred pounds and I think he has got about $2.42 from his herd for each dollar's worth of feed consumed; and the poorest dairy in the herd was paid the owner about eighty-six or seven cents for each dollar's worth of food consumed. One of these fellows has realized that he has a good herd and the other fellow has realized that the herd has got him. And those things happen wherever there is a cow testing association.

I had the pleasure last winter of visiting a large part of the dairy section of Vermont, and in every particular county there every little while, as I was looking for Jersey cows, having some Jerseys, every little while someone would say to me: "Have you seen Deacon Harvey's herd?" "No, I have not got there yet." "Well, he has got the best herd in this country." And in a little while some other fellow would say: "Have you seen Deacon Harvey's herd?" And I would say: "No, I have not yet." "Well, he has the best cows in this country." After awhile I learned I was a couple of miles from Deacon Harvey's. So I went up to Deacon Harvey's and out from the house came a nice, genteel looking old Vermont Yankee. And I said: "Mr. Harvey, I heard much of your herd of cattle and if you don't charge too much I would like to see them." He said: "If you don't get too close it won't cost you nothing." I went over to the barn and he had a large herd, in the neighborhood of 50 head, of the most beautiful uniform type of dairy cattle it was my pleasure to see in the State of Vermont. And I looked them over very carefully and I said: "Uncle Harvey, what price would you say for cows like these?" He said: "It would not be right to price them. I would not care to price them It would not be right." I said: "It is a good time to sell when you have a buyer. What would you ask me to pick out a few and let me depend upon my own judgment? I may get the poorest ones as well as some of the good ones." He said: "Well, I need a little money, and if you mind to pay $60 a head you may pick out a few." So I picked out three and I went up to open the stanchion to let the fourth out and he said: "Hold on, Mister; I won't sell another one." Well, I argued with the old gentleman but could not get any more. When I drew him my check for those three cows, he saw my name on the check and he said: "Are you the President of the National Dairy Association?" I said: "Yes sir; I have that honor." He said: "Well, you must know Governor Hoard." I said: "I certainly do. I am

to say that Governor Hoard is on my list of most intimate friends." "Well," he says, "when you see the other gentleman give him my regards. When you first came here you told me that that was the best of dairy cows you have seen in Vermont and he is to blame for it. You told me that this stable was one of the good old stables, and he is to blame for it. Twenty-eight years ago Governor Hoard stayed over night with me here and he took a pencil and he drew out a plan of a dairy barn, and this was the plan. And he told me to always use a thoroughbred sire, and I have always done it." Now, what was the result? There was not an animal in that man's stable but what any buyer of cows would have been glad to have bought at his price, not your own; and still you find to-day hundreds of dairy farmers throughout this land of ours using inferior sires upon their herds, and it is the greatest mistake the breeder of dairy cattle or any other kind of stock a man can make.

Going back to Governor Hoard just a moment: I trust that everyone here is a reader of "Hoard's Dairyman." I doubt if there is an article or an issue of "Hoard's Dairyman" but what if the dairy people of this country would read properly they would find some section in that publication that would contain all sufficient knowledge to pay them for their entire year's subscription; and I am not selling "Hoard's Dairyman," and have no stock in the publishing company. That comes from the heart. At the last meeting of the National Dairy Show when I first met Governor Hoard there I shook hands with the old gentleman and I said: "Governor Hoard, how well you look and how glad I am to see you." That old gentleman put his hand on my shoulder and said: "My son, these remarks are very kind of you but they are very untrue because I am soon going to that Great Beyond from whence no traveller returns." And I want to say, Mr. Chairman, that when Governor Hoard passed to the Great Beyond the dairy industry of this country lost the best friend it ever had and I doubt if it will ever get one as good.

In the course of my talk with the Governor I said: "Governor, did you ever meet an old gentleman by the name of Harvey?" "Yes," he says; "Deacon Harvey, way over in Westminister Valley, Vermont. Some twenty-six or twenty-seven years ago I spent a night with that good old Yankee friend of mine." Now, if it had been your Chairman or myself that had met Deacon Harvey we would have said: "I don't remember." He remembered twenty-eight years ago.

Now, Mr. Chairman, I got to leave you at three o'clock and I think I had better go down and pay my hotel bill; but I want to say to you and your association that I have enjoyed my visit here very much, and I am very, very much pleased at your meeting, at your attendance here. There is only one thing wrong with all dairy meetings. The fellow that you want isn't here. The fellow that you want is home, back down in his narrow confines and he says: "Them fellows down to Harrisburg think themselves pretty smart." That is the trouble. And he is the fellow that ultimately will be driven out of all business. There is no business on earth that will stand the losses and the slip-shod methods that the dairy interest of this country is standing to-day, and there is not a branch of industry that is making more money than dairying along twentieth century lines with a good herd of cattle and watching the business.

I want to talk about the fellows we want and are not here. How can we get them here. I don't like to tell stories in a meeting of this kind, but a fellow once said to me, "How are we going to change the methods of these old men, these dyed-in-the wool and burnt-red fellows, how are going to get them to do it?" I said, "There is only one way and that is like the Irishman who was about to die and sent for a priest to come and pray for him, and after the priest had prayed with him for awhile he said: 'Now, Pat, is there in anything further you want, if you have any sins you need forgiven, you better be thinking about it because you have but a few moments to remain.' 'Well,' says Pat, 'there is something I'd like to speak about, but not unless you know that I am going to die pretty quick.' The priest said: 'You only have a few moments and if you have any sins to be forgiven you better speak about them now.' 'Well,' said Pat, 'I wanted to convert a Jew.' 'Well,' the priest said, 'it is no sin to convert a man, and if you converted a Jew it is an honor and a credit instead of a disgrace and a sin. Pat said: 'Wait a minute, Father. I used to run a ferry-boat and one day I was rowing a Jew across and he fell into the water and I raised him up and I said, 'Do you believe in the Holy Catholic Church?' and he said 'no sir;' and I shoved him down again; and in a minute or two I raised him up and I said, 'Do you believe in the Holy Catholic Church?' and he says no, and I shoved him down again; and I raised him again and I said, 'Do you believe in the Holy Catholic Church?' and he says, 'yes sir,' but I could not believe the Jew and I shoved him down.' "

You ask how are you going to get the fellow here you want. The Lord knows, I don't. But I like to see a meeting of the dairy farmers of this State and to have them talk about legislation. I believe it is part of the duty of the State to have inspection of milk, and if that inspection could be made by inspectors who had a knowledge of the business sufficient to entitle them to that title of inspector, the closer the inspection could be done the better and that would force the little fellow out. I wish I had the time to spend, I would tire you out. I have seen all sides of the milk problem. The producers of milk, as a rule, do not realize how important their work is. If they did they would make their dairies better. They don't realize that 65 per cent. of the babies born in this land are raised upon the milk from the dairy cows, the foster mothers of the nation. And now, Mr. Chairman, it is a terrible thing to say, but it is true and I hope there is none in the hearing of my voice, but I know there are thousands of dairymen that are milking milk from diseased cows and putting it into the cans and shipping it to the city to be consumed by those sick and dying children. I know that is true in Ohio and I know Ohio is not so much worse than Pennsylvania. I wish that the time would come when we would have all such people driven out of business and then the fellow who makes good milk will get compensated and not until then.

MEAT DEMONSTRATION

By H. W. NORTON, *Howell, Michigan.*

The question of quality of meats is one that has not been considered and understood to any great extent until recently. A few years ago there was not much attention paid to that subject, and meat was taken in the carcass and sold strictly on the weight basis without any consideration particularly to the fineness of the quality as indicated by the different points which we consider, and it is not until very recent years that any particular attention has been paid to this subject. The addition of the dressed carcass competition class at the International Livestock Exposition in Chicago has done more to excite interest in the question of quality in meats than anything else; and at the present time every year we have in the Chicago stock show a dressed carcass competition in which the best stock are judged on foot and slaughtered and judged on the clean carcass. The judging on foot does not always agree with the judging of the clean carcass, which shows that the science of judging beef is not an exact science. At the present time it is not quite so thoroughly understood as it will be after a few years when more attention has been paid to it and we have more slaughtering tests and more work done. These two cattle that were used by Prof. Cochel yesterday afternoon over at the Market in the livestock demonstration will be shown here this afternoon in the cuts, showing you the difference in the two carcasses after they are cut up over the block. In preparing these two carcasses I have had the side of each one cut into the wholesale cuts and these will serve to show you the difference in the development of the cuts, the difference in the size and thickness of the flesh, the grain, the fat, color and different points taken into consideration in judging the carcass. It might be well at this point to take a few moments to consider the judging of carcasses.

In the first place, for a carcass to be prime, to be selected as a prime carcass or credited as a prime carcass, it is necessary to have a high dressing per cent. The reason for that is that the dressing per cent. depends largely on the condition of the animal, the meat, the fat the animal carries. The fatter the animal, generally speaking, the higher the dressing per cent. This is the most important point in controlling the dressing per cent. Aside from the amount of fat that the animal carries, we have also the breed. Steers of the beef breeds will dress a higher per cent. than steers of the dairy breeds. This is true because the beef breeds have been bred for a great many years for the thick, heavy carcass. The dairy cow has been bred for capacity, for refinement in form, for the incurving thighs, the curved ribs and low hind quarter, etc. If you are looking for dairy cows and find one that is fat and meaty,

you discard her, saying, she puts her feed on the back instead of in the belly; and along that line steers from the dairy breeds will not dress as high a per cent. because not so thick and meaty. There is more waste in the internal organs. The digestive capacity has been developed to increase the capacity in the dairy cow and all the steers take the same points in their development and so the steers of the dairy breeds will not dress as high a per cent.

Another fact which has to do with the dressing per cent. is individuality. There is a difference in steers of the same breed which we can only account for by individuality. In the slaughter tests in the Michigan Agricultural Colege along the line of determining the dressing per cent. of cattle of different market grades, and to illustrate the differences which you find in cattle of different grades, we took steers of the five market grades as you find them quoted in the different livestock dailies and the daily papers, prime, choice, good, medium and common steers. There were slaughter records kept and they showed that prime steers dressed on an average of 63 per cent.; the choice steers, 61.9 per cent., about 62 per cent.; the good steer 60.7 per cent.; the medium steer about 58 per cent., and the common steer 56 per cent. These figures, of course, would vary a little. These figures are not necessarily the figures that would be shown for averages of cattle of these grades, but they grade down very nicely from the best market grades to the poorest. The breeds will also show some variation. Figures taken from the slaughter tests that have been conducted by the different experiment stations throughout this country show that the beef breeds, for example, the Shorthorns, Herefords and Angus, in the averages of all slaughter tests taken showed a dressing per cent. of 63 per cent., 64 per cent. and 65 per cent.; while the dairy breeds as compared dressed 60 per cent. to 62 per cent., a difference of some 3 per cent to 5 per cent., and with a much wider variation, but these are average percentages. There is also a difference in the dressing per cent. of heifers and cows as compared to steers. Steers will dress a higher per cent. than cows or heifers. That fact is one o fthe reasons for the difference in the prices paid for steers over heifers in practically the same condition in the market. The buyers always prefer the steers when they can get them and largely because they will dress a better per cent. When we come to judge the carcass the high dressing per cent. is important because it indicates that the steer it fat; it indicates a finished condition, or a fat, finished condition.

JUDGING CARCASSES

To take up the points of judging carcasses, or meat in detail as they would be followed through, if you were watching a judge in a carcass contest, the first would be the sides that were hung in the coolers and the judge would examine them, having his figures to show the dressing per cent.; having looked them over he would examine the sides for the general conformation or shape. The shape that is desirable is a very compact, very thick fleshed, compact, solid, blocky form; just the same practically as you like in the live animal in judging fat steers or cattle. In comparing the sides we like to find the hind quarters or the round very full, thick and short. Now if I had a rack so that these quarters could have been

hung up before you it would be possible to show something about the difference in conformation, the difference in shape of these sides, but not having any place to hang them up it is impossible to do that, but perhaps I can show you on the cuts when we come to the cuts. The round should be very full, the thigh full and fleshy. If you compare heifers with steers, in the round the steer always shows fleshier and more compact round, while the heifer's is inclined to be thin and incurving. The round should be fleshy down onto the hock. The meat should run down to the hock so that the shank is very short, so that there is very little shank not covered with meat. The loin should be full and smooth, showing no depression on either side of the backbone, but rather filled out full and rounded, showing that the carcass should have on bunches of flesh, plenty of loin meat and make a nice thick loin cut when you come to cut up for steaks. The ribs should show some conformation, well sprung from the back, not a sloping side or flat and not sprung out too full so that we have flesh over the ribs. We want them well arched out from the back so that you find a good "eye," a good large amount of loin when you come to rip them down. This is what the butcher calls the "eye" of the beef. When you come to rip the side, rip them down, cut off the fore quarter from the hind quarter, you expose this muscle. That is called the "eye." And as the carcass hangs from the side we like to find the flesh full and thick on the hip and not sloping off, so that they will show a thick, full muscle. Of course, the thickness there is sometimes deceiving and while the carcass may look good in the side when you come to cut they may not be as thick as you expected and the knife is the only safe index to follow. You may be easily deceived by external appearance.

The shape of the front quarter is important. The butcher likes to have the chuck well developed, thick, not heavy and showing too much weight in the front quarter, but should be thick and compact. The neck should be short, as little neck as possible, and on prime steers there should be practically no neck. This is an inferior cut and the butcher does not care about much of that. The least neck the better.

The next point after considering the form or shape of the carcass would be to consider the covering of fat. Now, for finished beef to have the prime quality it is necessary to have a very good covering of fat all over the body and completely covering it. The covering as shown on this best steer, when you come to look at these cuts I will show you there is quite a difference in the extent of the covering, the completeness of the covering of fat. A good layer of fat all over the body, as complete a covering as possible, is desirable in order for meat to hang in the coolers and ripen, in fact, it is necessary. A high class trade desires meat that is left to hang in the coolers to ripen and for meat to be properly ripened in the coolers this complete covering of fat is necessary. Poor cattle, where that covering is lacking, will not hang in the coolers and stay in good shape. They become soft and slimy and you cannot hang them any length of time before they spoil; but cattle well covered could hang in the cooler for any reasonable length of time and still be all right, and the ripening would increase and

improve the quality, instead of making it poor as it would with poor cattle. The covering of fat should be complete, extending over and covering all parts. Coming down on the round as the sides hang up the round should be well covered. It should be covered last; or, if covered up on the round the rest will be covered. The color of the fat is an important point. The color should be white, the whiter the better and white rather than yellow. The white fat is considered as an indication of young beef, while if the fat is very yellow it indicates age.

This is not necessarily always true. Cattle from some of the dairy breeds, as Jerseys and Guernseys, will kill yellow even at two years, especially the Guernsey's coating. They show a very rich orange colored skin and that color seems to sift through the fat, and two year old Guerneys will dress yellow and will sell as cow beef. The color is not necessarily controlled by the breed. Lots of cattle of the beef breeds will sometimes dress yellow. It is due a great deal to individuality. You cannot tell until the steer comes out of the cooler whether he is going to dress nice and white or not. The fat covering should be complete but not too great. Generally there is no trouble with cattle too fat. The kind of stuff that comes on the market in the smaller cities is usually unfinished rather than overdone; while in the big markets we come across cattle too fat, great soft or large bunches of tallow over the ribs, round, tail head and rump, and that would be objectionable. But generally speaking, in order to get high class beef and sufficient finish to make it we must have some waste fat or tallow. There must be some trimming, and when we come to cut up these big steers there will be some considerable trimming on some parts; but in order to get the best grades of beef some trimming is necessary.

The coloring of the lean also, when you come to rip them they should show a bright rich red color rather than a dark color. A very dark color is undesirable. Poor cattle without much fat and old cattle generally dress dark; but good prime beef should show a nice bright red color, not perhaps too red to be fiery, but a nice rich red color.

Those are the points you take into consideration principally in studying quality in beef; the dressing per cent.; the general shape of the body; compact, well filled, thick round; thick loin; and well shaped on the ribs; good thick, compact chuck, but not over-developed in the front quarter; and short light shanks. The smaller the bones as indicated by the shank, the better from the butcher's standpoint. There will be less bone trimming and when you buy a piece of meat you get more meat and less bone in the cut, or a greater proportion of meat to the bone.

The graining of the meat and fat, that should be very firm and fine grained, not too coarse, not soft; it should be very firm. We have to make some allowance for these cattle (showing) because they were only killed yesterday at one o'clock and have not had sufficient time in the coolers to harden down. They ought to be left in the coolers for at least twenty-four hours more; a little more than that would have been better. They have been cooled out very well considering the length of time they had. The big steer is pretty well cooled down for a heavy carcass of this sort which was only in the coolers for twenty-four hours. The fat should be

very firm and the hardening of the fat is what gives firmness to the carcass. The fat mixed through the lean when hardened down gives firmness to the carcass. You take a side of beef from a poor steer where there is no fat and it is impossible to harden it except by freezing. Cooling them down does not give them that firm, solid condition that we look for in good beef. The muscles slip back and forth and are soft and slimy and you cannot harden them. The mixture of the fat through the lean also is important. For proper finish we like to find the fat well mixed through the lean, a good mixture of fat; but this does not mean fat in there in bunches, the way it would be more apt to be in the dairy breeds if put in here, but marbled through as the butchers term it, or mixed through in small particles, splashes of fat mixed in through or flaked in; and a proper marbling mixture of the fat through the lean is necessary for finished beef.

Now I will try to get some of these cuts in shape (showing) so that you have a chance to look at them and see just how they show up. Now, in comparing these two ribs cuts from the two steers, these two cuts made in the same place show you quite a fine comparison of the two. The larger rib cut there is from the big steer, the white faced steer, as they stood before you in the ring yesterday, and comparing these two you can see a marked difference in the amount of fat covering around the surface of the lean meat there. This one here has a very small covering and the lean through the eye—this round muscle is the eye—is not nearly so thick on the rib and has not so much fat mixed through the lean, and the eye here while a well developed eye and good piece of lean meat is not so nicely marbled and finished, not showing the mixture of fat through the lean that the other one shows. Now this cut here is finished very nicely. There is a nice mixture of fat through the lean, marbling through the lean, and we have a good layer of fat over the surface. That is just a little bit more fat on there than desirable in most markets. For high class trade such a cut in large cities like New York and Chicago, this one here would be exactly what they look for and the butcher and retailer could handle this to a very good advantage. For the ordinary retailer though one which has not quite so much fat more like this one here would meet the demands of a great many. The most of the retail dealers in the small towns where there is not a high class special trade would not like that. Of course, this one here is without doubt the best cut, has the best flesh, the best quality of the two, but the reailer could not afford to handle this one in a great many cases because he could not get the price for it as he would have to trim off and he would not be catering to a high class trade enough to afford to trim off this one. A mixture of fat thrugh the lean shows that it is finished.

In finishing cattle the priming up is to improve the quality of the meat, not to increase the size of the animal or weight so much as the quality. The weight is produced in growing and quality another man very often buys them up as feeders and finishes them improved by finishing. The feeder generally grows the animal and another man very often buys them up as feeders and finishes them and the work he carries out is to improve the quality. A mixture of fat through the lean improves the quality of the meat by making it tender and more juicy and increases what the chemist calls soluble

extracts which gives it better flavor, and tenderness and juiciness and flavor are all important in finishing, and these are the points which govern quality in judging cuts. That is the prime object in improving quality. In comparing these two you have a nicer color in the top one, the fat is very white, the lean is a nice red color and there is a very complete covering and nice mixture of fat through the lean; while this one has yellower fat, a thin covering, is not so nicely colored, a little bit dark or dark spots through that and the quality would not be as good.

Now in comparing these two cuts, the two loin cuts as they are taken out, you will notice that on these two there is quite a difference showing in the size and in the shape. The cut here from the larger steer is very much thicker, fleshier and heavier, more meat in proportion to bone, very much more meat in proportion to bone, the fat is mixed through better, more fat mixed through the lean in the case of the larger one than the smaller one and there are a few bunches of fat in this cut. What we like is to have the fat mixed through the muscles, not laid between the muscles in large quantities, that is not desirable. You will notice the fat covering the surface in these cuts. We have just a nice covering here, around here; up here there is no covering at all, and if you compare these two cuts you see on the surface that the loin from the big steer is completely covered, has got a smooth even covering; while the one from the smaller steer shows dark flesh there, showing where the lean shows through the covering and practically not covered; just a little membrane, not much fat covering. You see on comparing these two chucks the difference in shape. The chuck from the big steer is fleshier and thicker chuck. When you come to cut them up, if cut up into steaks, the thickness has a great deal to do with the amount of steaks, and you get more steaks and better quality out of this kind of a chuck than you would from thin cattle, and comparing these two you see quite a difference in the thickness. This one here is round, full and thick, and this other one is flat sided and does not show the development, and the marbling you notice in the meat of the big steer it is nicely marbled and through the fat and lean it shows the finished condition.

Well, now, I will cut up these other two quarters and cut them up in what would be the method of cutting on the Chicago retail market. The cuts that I will make will probably be different from some that you may be familiar with in this part of the country but that will probably be brought out later on with the questions. The first cut that we make in cutting up the front quarter is to take off the shank. The shank would be cut off just a little bit below the elbow bone and running on the top line of the quarter and would be used principally for soup meat or the lean could be cut up and made into hamburger or mixed into the sausage, but is principally used for soup meat. The wholesale cuts of the shank make up about 4 per cent. of the carcass, generally about four per cent. in the Chicago wholesale cuts. It is difficult to handle a quarter of this size without having it on the hooks, cutting on the hooks it would be much easier to get at it and it could be done much more rapidly. Now the next cut after removing the shank is to take off the plate, the lower part of the ribs. We would start at this point, cutting into the pit of the shoulder, then cut between the ribs

there and off across the cut made in taking off the shank. That cut removes the plate which is the lower part of the ribs, including this back part here which is called the navel, the front part which is called the brisket and the plate altogether. This one cut makes up about fourteen per cent., generally fourteen per cent.; of course, it will vary somewhat in the way it is cut. The plate is one of the hardest pieces to cut up right and it is used for making short ribs of beef. It is also used largely for making corn beef, cured and salted for corn beef. In cutting the front quarter into meat for the Jewish trade, for what they call "Kosher" trade, they would cut the first five ribs right off from the front end of the chuck, including the first five ribs, cutting through here down to here; that would leave these ribs here; follow along that down to here. The next cut on the front quarter is removing the prime rib including the same cut I showed you on the other side of this cut here. This is a fresh cut. It shows a little better than the one I showed you before. It shows marbling and mixture of fat and lean in this case very nicely. All the lean is mixed through well with fat, showing a nicely marbled cut. There is a little too much fat there in one or two places. That is cutting as it would be on the Chicago market, when you cut one rib on the hind quarter, and would include seven ribs coming back on the last rib as it is here. It is the eighth rib. This is the prime rib, the best rib, where you get the best rib roasts. That is where you take out the rolling and standing roasts, cutting off the rib or couple ribs there, that would be rolled up and would make a very nice rolled roast. That leaves the chucks which is sold as a wholesale cut. The chucks as cut in this way would run 26 per cent. of the carcass. The rib there, I did not think to mention that, would be about eight-tenths per cent. Generally the chuck is 26 per cent., the shank 4 per cent. and the plate 13 per cent. or 14 per cent. The chuck would be used for cutting up in cattle of this sort, back there, these ribs, and the front part used for roasts, cutting off a couple roasts across the arm here and a couple of these arm roasts and leaving the shoulder, it would be used for shoulder roasts and the neck used for boiling meat. You will notice I was speaking in good cattle we like to find the neck short and small, not showing any neck. If you notice the neck on that chuck you see practically no neck. The steer's head was fastened on the shoulders, the neck very short. You take a steer of poor quality, poor breed, it would show more neck than on this. The neck is only three or four inches long and it has not been trimmed. It is right next the head.

On the hind quarter we start cutting up the hind quarter into these four wholesale cuts. First, you take off the flank, starting inside the round or thigh and taking off this flank or muscle. The flank will make up four to seven per cent. depending largely upon the condition of the steer. A very fat steer will cut more flank than a thin one because the flank is one of the places where the fat is deposited heavily. The fat on the flank is very thick in fat steers. The flank will run from four to seven per cent. on the general figure; on ordinary cattle, four per cent. The flank steak is cut from the inside. This muscle here is pulled right out and that is the flank steak. The rest of it is generally used by the

packers to make corn beef and chopped up to make different kinds of sausage and boiling meat.

We next take out the kidney fat or suet. This is the best grade of fat on the body. It varies largely, depending on the condition of the animal. We figure four per cent. It will run higher than that in very fat cattle. But cattle of poor grades when highly finished, the dairy steers or steers of inferior quality, when very fat will cut more kidney fat than well bred steers. The dairy steers and steers of poor quality when they are fat will put more of their fat on in places where it will be trimmed off, more in bunches, and they get very heavy kidney fat generally.

The last cut on the hind quarter to make the wholesale cuts is to take the loin from the round and in making that cut you cut in front of the aitch bone here, removing the loin and separating the loin from the round. The loin makes up about seventeen per cent. of the carcass; the round about twenty-three per cent. The loin is the best part of the carcass, from which you get the best meat. The front end gives the porter house or pin bone steak and the sirloin is cut from the back part of the loin. Cutting up the round further, the first cut would be to remove the top part here, cutting off the rump, and cutting that off you cut just below the point of the pelvis or this aitch bone as commonly called by the butcher; cut just below that and then remove the rump from the round. This, as it stands now, before cutting any more, is what the packers term a wholesale round. It makes up twenty-three per cent. of the whole carcass. This top of the wholesale round is the rump, used by the packers largely for corning, making corned beef, and makes a very good roast as the retailers handle it. It is largely pinned and put out as rump roasts and makes a good roast. The rest of the round as considered in the retail market, this portion here, is made up into round steak, cutting about one-half inch thick or three-quarters of an inch thick, or made by cutting thicker, made up into round roasts. The packers make a lot of that into smoked beef hams and dry beef. If handling one of these to make into dried beef you will notice natural divisions between these muscles here. We cut down on this here to the muscles. You can separate and tear them right apart, getting several long strips. They are used at the lower end to cure and smoke for making dried beef. But if cutting up into retail cuts, into steaks and roasts, the lower part here would be sold for the butt roasts or boiling pieces. It is tougher, more tendons or cords. It is cut off from the bone making a crescent shape or horse shoe shape and used for butt roasts or boiling meat; and the rest of the shank is used for soup bone.

The SECRETARY: Which is the tenderest piece in the round steak?

MR. NORTON: The tender part of the round steak is the inside part here. The inside muscle of the round steak is the tenderest part. And the loin, in cutting up the loin you often hear the question asked about the tenderloin. The tenderloin is this muscle that lies right on the inside of the body there between the suet or kidney fat that I have taken out and the back bone; on the in-

side of the body, the tenderest muscle in the body, and for that reason is demanded and high price paid for it by a good deal of the trade. It is not so juicy and so well flavored as some of the other parts or cuts, but more tender, and that is a very important point. The best tenderloins that are put upon the market, if we start them up here, this line, it would spoil the porterhouse and spoil the tenderloin or true porterhouse. For that reason the most of the tenderloins put on the market come from what they call stripper layers, the loins of transport cattle, a poor class of cattle, where stripped out and disposed of to the best advantage, the cheapest part being put into canned beef. Stripper cattle furnish most of the tenderloins that go to supply the trade, as well as from the poorest grades of cattle. They also take some from the better grades that are so bruised in shipping so that the loin cannot be sold over the block. In that case the tenderloin could not be injured, being on the inside of the body, and the tenderloin would be stripped out and sold as tenderloin of the beef, and the rest of the beef, especially some of the part which would not be hurt, put on the market as muscles from cattle injured or bruised in shipping.

A Member: Where?

MR. BAYARD: Right here. If you want to look at it just go up and look it over and come down here and bid on it. We will sell it by prizes or anyway you want to bid.

A Member: A gentleman in the rear wants to know where you will sell the apples?

MR. BAYARD: Right here after we are done with this. We cannot carry them down.

A Member: The gentleman back here wants to know whether they will be there after they are sold.

MR. BAYARD: They will. I will sell the prize winning apples; but I want to say to you that you cannot take your corn away because it is to go to the National Corn Show where it will win some more glory for you.

PORK

This side of pork is from one of the animals used in the judging ring yesterday. I will cut this up, showing the different cuts as we would cut it if going to cure the shoulders as pickled hams and going to cure the hams, showing the different cuts made in trimming up these shoulders and hams, making the loin to be sold out as loin from the retail shop.

First, take off the shoulder, cutting as I have cut this one back of the fourth rib. This is not necessary. If you want to make a heavy shoulder you cut further back and for a lighter shoulder you cut only three ribs. Up at State College we have been just starting some experimental work in curing hams and shoulders and cutting them up the same, cutting them between the fourth and fifth ribs, and cutting that way you notice this shoulder would be trimmed out and the first trimming would be to take out the spare ribs, cutting close to the bone. That gives you what they call butch-

er's spare ribs. It is very thin spare ribs, of course, used for packing up and roasting. It is quite a choice cut but not cut heavy like what we call farmers' spare ribs. The next cut will be to cut off the shoulder butt, right across the top, about one-third the top, what the packer would call the shoulder butt. The top across the top of the shoulder blade. This would be called a shoulder butt. Trimming off the fat we would have the fat separated like this. It is called the clear plate. This plate or piece of lean taken out would be called the clear plate and that is used by the packers and cut up into chunks, put down in salted brine and shipped to foreign countries and also somewhat used in this country for certain classes of trade in the mining and lumbering districts, and it is known on the provision market as clear plate. Ordinarily the farmer would simply trim that off, of course, taking off the rest of the lean and use it for making lard. This lean portion that is left from the shoulder fat is practically all lean meat and makes a very nice roast, or if sliced across this way, crosswise, about one-half inch wide, about the thickness of pork chops it makes a very nice steak and is called "Boston Butt" by the packers.

Now, in cutting off the ham from the middle, the point where you make that cut is dependent upon whether you want to make a heavy ham, and if you want to make an American ham we cut halfway between the aitch bone and the rise in the backbone. You notice at this point on the backbone there is a rise; the back bone curves up there in the pelvis, and here is the aitch bone. It is split when I opened the hog up to take out the intestines; cutting half way between, so as to make an American or short ham. If we want to cut a heavy hame, cut further up in the loin. This end will give you your ham right if trimmed up and shaped. The packers would trim that up, starting with the tailbone and striking around here and taking out the tailbone and also cutting on this side back, taking off this flank here and smooth that up, taking care not to take off too much flank because the flank will shrink in curing and if trimmed too close the flank will draw down to the flesh and will not show up as well as if trimmed long. In curing they shrink considerable. The trimmings, of course, would be used for sausage meat.

Trimming off this loin, you notice how thick the fat; this furrow over the back there; this shows good form. Cut right along the back, splitting the back bone, you have a layer of fat four inches all the way along. It is a nice fine layer and very firm and hard considering the length of time it has been in the cooler. It shows good quality; and the cut made to take off the lean, you start on the ridge a couple inches from the center of the backbone and bring the cut out at the lower end so as to leave all of the tenderloin in the loin, so as not to cut into the tenderloin, to run out at the edge of the tenderloin, the round muscle on the inside, the same as on the beef. This loin, trimming off the fat would be what the packers call a wholesale loin, after the back fat is taken off. This wholesale loin where you get the pork chops, cutting the rib chops from the rib end, the upper end, and the loin chops from the lower end where the tenderloin muscle is lying on the inside here. The rest of it there that I trimmed off, this clear fat part, is called the fat back. It will be chunked up into pieces five or six inches square

for packing up in barrels and tierces and brine and salt as fat back, clear backs. A certain class of trade will consume clear fat meat of this sort and it is used for that trade and also a large part is used for making lard. The best quality of lard comes from the leaf. This had a very heavy leaf and that was the prime lard on the carcass, and the next grade of this is fat back I take off the loin. The packers in making up the best grade of lard—the best grade would be 40 per cent. leaf and 60 per cent. of this fat back—they don't make any pure leaf lard. Of course, the leaf forms a small proportion of the lard in the carcass and they mix that with the best lard from the back, the best grade of fat backs, to make their No. 1 kettle rendered lard. The rest of this should be cut up just as it stands into pieces five or six inches square and cured, salted and put in brine for mess pork; or the rib could be taken out the same as the spare rib and the rest of it cut up into chunks. On the farm that heavy fat of this sort and ribs are taken out and the lean separated from the fat and the lard rendered and the lean made up into sausage. For making bacon or anything of that sort it would be out of the question. It is too heavy. According to market requirements fat bacon hogs should weigh from 160 pounds to 200 pounds and small hogs of that size should be cut into bacon, and heavy hogs of this sort should be cut into mess pork, barrel pork and hard salt pork as commonly called by the packers.

SUCCESSFUL CORN GROWING

By PROF. FRANKLIN MENGES, *York, Pa.*

I have been on this corn breeding work for about eight years, and I have found out only a few things in farming, because I cannot devote all my time to it, but I have to make a living and a fellow cannot make a living breeding corn in Pennsylvania just now. There is not enough money in it, but I believe there is enough money in it for every farmer to go into it and do it for himself; and I think I am talking to farmers who own farms and live on them, and farm them. I don't know how it would be with a fellow that rents a farm to go into anything of the sort. I do not know how it would be. I do not know how it would be for the man who rents his farm to the other fellow, whether he ought to go into it. I do not know how it would be for him; but I am talking about the man that owns the farm and lives on it and works it. I believe it would be a paying business.

Another thing I have learned, I have learned that corn can be developed for any particular section of the State. I have learned that. You cannot buy your corn by going to Ohio and bring it here and for the first two or three years get results such as you ought to have. You cannot do it with any Western corn. I have tried that several times and I say you cannot do it, but I have

found that if you get a corn that is adapted to your soil, your climatic conditions and the seasons that you have at your disposal for growing corn, when you have such a corn, that is the corn to work on, and every farmer ought to have experience enough to know when he has got that kind of corn.

The first thing you want is quality. I say that is the first thing, you want to get as much corn and as good corn as you possibly can get on your farm. I said a little while ago that you can develop a corn that is adapted to the soil and climate you have. Last summer, that is only this last year, I had an experience that convinced me more of the truth of the statement I am making now than anything that has happened. I had about two bushels of the best seed corn I believe I ever had. The man that I used to work with died last winter, that is this winter a year ago, and I had to get somebody else to work with me on this business, and I went to a fellow whom I knew very well. He said we can do that work on our farm and we have better land than you have over there. That was true. We had ground that was on the Messasoit sand stone. I do not know whether you understand me when I am talking about this, but it is this red soil, we have in York, Lancaster, Chester and Montgomery counties. You know what it is Mr. Sharpless. On that kind of soil we raised the corn, and I say it was good corn. We took that seed corn and planted it on the richest soil in York county and I thought we would get a crop of corn that we could brag about for years, but we didn't for some reason or other that I cannot explain—I am not here to explain—for some reason or other that corn reverted. It went back to its great-great-grandfather, a whole lot of it. Some of it had big cobs, but we didn't have any corn like that, not at all. Some of it was short grains; some of it was not filled out and all that kind of thing; and I cannot blame anything but different soil condition.

A Member: You planted it in the wrong time of the moon.

PROF. MENGES: No, sir, we have gotten away from the moon in York county. Some fellows had it shining around here, but that has not anything to do with our corn. I cannot explain it, but that very corn on the Messasoit sand stone, the red shale, had yielded up to ninety bushels to the acre of shelled corn, the corn I am talking about. Now how did we do it? That is the thing you are interested in, I know. We started out about eight years ago with the improved Leaming corn, but I did not know very much about it then, and I do not know very much about it now. But we started out to select the stock that gave us the very best kind of an ear, and the very best kind of a stock under normal condition. We did not take that stock that stood out there by itself and produced a big ear. You know when you select the large ears out of a lot of corn and don't know what stock it came from you don't know where that stock stood, or what kind of environment it had about it. So we want to know the environment. We want to know whether that stock that produced the large ear did so in an environment where any other stock had grown and produced an ear, and that stock that produced the largest ear and the right kind of an ear, and the right stock, and the right foliage, and the right kind of a

tassel and the ear at the right height, that was the stock on which we selected the seed corn to begin with. But I want to say to you that takes a little bit of work. Now, we have found this, that when we select seed corn from the stocks that have done well under the environment where it had to fight for everything it had gotten that you gain a strength of character behind it that you do not get when you select the seed corn right at random right out of the pile. We have found that.

Now, then after working along that line for a little while we went to corn breeding. We selected the best ears we could find, those that suited us best, and we planted those ears in the rows by themselves. Suppose we had an ear here that was just exactly what we wanted, and we took the corn from that ear and we planted it in row No. 1; and suppose we had another ear that suited us very well. We took the corn from that and we planted it in row No. 2, and the corn from another ear in row No. 3 and so on until we had twenty or thirty rows. We had that corn there pitted against itself just exactly as you dairy men do with your cows. You know what every cow is worth to you and what she produces in money for you. You can do the same thing with corn. And then we watched that corn and, gave it good cultivation, the kind corn ought to have. We planted in rows three and a half feet apart, and three feet apart in the row. That is two stalks to the hill. That is thick enough planting. A lot of people plant pretty near twice as much as that, that is, twice as thick. But I want to say you are doing it at the risk of getting quantity when you plant that thick. You get nubbins when corn is planted too thick, and you do not want nubbins. That is the thing we have been fighting. We had these twenty or thirty rows of corn running parallel through the field and we could see what they would do. They were up against each other in competition. And what did we find? We found here a row that would have a lot of nubbins, by selecting the very best kind of an ear you see. Then we had another row that had barren stalks in it, then we had another row—and this happened last summer,—after seven years work along this line—then we had another row with ears away up there, six feet above the ground, entirely too high. I say this very thing happened with the ears of corn last summer in my case, after seven years work on this line. I cannot explain it. That row of corn did not ripen out of the limits of our season. We have about one hundred and twenty days, fully one hundred and twenty days in which to ripen corn. Still you have another kind of a row. You have another one that had weak tassels, and another one that the ears are produced too low on the stalk they riped too early, do not take up the entire season.

And so you can pick out. You have here an opportunity of seeing just exactly what the results are and that will give you a pretty fair average of what you have in your entire crop, to show just exactly what those ears are capable of doing and what will be the result. Now, select the seed corn from the row that has given you the largest quantity. We ought to do that; but I did not always do it. Now, always. Why not? Because some of these rows had produced a lot of nubbins, two ears on the stalk and not very large ones, and I do not like that and I am growing corn. Mark this,

I am trying to get a stalk of corn that will produce one large ear. Now, what do I mean by a large ear? I mean an ear that will shell about fifteen ounces of corn to the cob. About eighty-six per cent. of corn to the cob that is the kind of ear I want. I have not done any work along this line of raising two ears on the stalk but want an ear of the size I have already indicated. That is the kind that suits me.

Now, after you have worked for these results awhile, I have worked on this line, and you have eliminated the rows that produced nubbins and barren stalks and stalks with ears away up here and others away down here, and with weak foliage and all that kind of things, and you have selected those that are doing the very best, and that is the kind I want—let me say right here that the nubbins will disappear. I mean that little fellow about this long (showing).

Mr. W. H. Ream, living on the same kind of soil I am talking about, the Messasoit soil, this last Summer in a dry season, had a crop of corn produced in the way I am trying to tell you and the shortest nubbin was that long (indicating). That is a pretty fair ear in some climates. The longest ears were twelve inches long, and that is the kind of ear I want, if I can possibly get it.

KIND OF EAR

The next thing that I am going to talk about is the kind of ear. What kind of ear do you want? We had some here to-day that suited me first-class. I want an ear twelve inches long as near as I can get it, but if I can't get a twelve-inch ear that has grains as long as a ten or eleven-inch ear has then I will take the ten or eleven-inch ear; I want the grains on the long ear just as long as on the shorter ear. Now, why? Because I always get more corn. Never sacrifice length of grain for length of ear. When you have to get an ear that has grain only one-fourth inch long, always take the short ear that a grain five-eighth of an inch long every time; that is my experience. And then what else? Then if I can get it—I know I am not talking scientifically when I say this—if you can get it have the rows straight and the grains equal size, and the butts filled out and the grains running over the top filled out. I want to get just as much corn as when the rows are crooked, and I take the ear that has straight rows provided it gives the quantity of corn, but if it don't do that, don't take it. I never do. It is quantity I am after. Take the crooked rowed ear provided it has a good body and more corn than the straight rowed one. While I say this is not scientific doctrine, and that is not corn breeders' doctrine, but that is what I do, and I am telling you what I do. That is what I know about it.

KIND OF SEED

Another thing I want to talk a little bit about is what kind of a grain do you want. You want a grain five-eighth of an inch long, and about one-eighth of an inch thick, sometimes not quite that much, and it ought to be a quarter-of-an-inch and a little more across. And then it should not be pointed like a shoe peg. Never plant shoe peg grains of corn. Now, why? Because they are low in vitality. They have not a good germ. That is the trouble, and there is where the trouble is, and you want as strong a germ as you can possibly get, and you do not get it in a shoe peg grain.

Now, then after you have selected this seed corn carefully, you want to take good care of it. The best kind of care of it. Put it some place where it is dry and where the air can get at it and dry it out so that there is not sufficient moisture in it to freeze when the temperature goes to zero and below. And then after you have got on that far and you start in with corn breeding,—and let me repeat again, I do not care what part of the State of Pennsylvania you live in you can develop a corn that will be suited to your climate and to your soil and the best corn to do it with is the corn that you have now. Go out there into that field, select the kind that we have talked about, select those ears we have said you ought to select and the kind of the grain and begin breeding from them and breed up five or six years, or seven years you will have developed a corn that will be better suited for the climate and soil conditions that you have than any corn you can get anywhere else, I don't care where you get it. I believe it is the bounden duty of the farmers of Pennsylvania to breed up along this line and do that work.

The CHAIRMAN: We have a few moments we can spare yet if there is any one that would like to ask the Professor a question.

MR. WALTER E. SEELY: I would like to raise a corn that has a high protein value, and I must go home from here not knowing which of these varieties is best. Would it not be possible to have a little typewritten list accompany these various types that we might have the information along with the show. This has been the first corn show that it has been my privilege to visit. I have read somewhere that different varieties of corn differ in their contents. I am not saying this to criticise, because older heads have brought this meeting about than myself, men of more experience, but I am going to say I am very much disappointed in looking over the varieties of corn here, that a little more of the history and analyses is not given with some of the varieties. I would like to raise a corn that is particularly high in protein.

PROF. MENGES: Mr. Chairman, might I reply to that question for a minute? It is not very difficult to determine the quality. I would not like to say composition, but the quality of corn, cut by the use of your pocket knife. Take your pocket knife and cut a grain parallel with the one side, lay it open and there you will see the various components that enter into the composition of a grain of corn. You have the outside hull, then you have the gluten, then you have the starch coming next to the germ, on both sides of the germ and then you have what you call the corn starch and the germ. When you have a grain in which that hard, horny gluten moves in and nearly touches the germ and sometimes entirely touches it, you can conclude that you have a corn that is high in protein, because eighty-five per cent. of protein in a grain of corn is contained in that horny gluten and in the germ. Now, that is the only thing to do, don't let it be understood that my talk would lead anybody to think that it is absolutely conclusive, but it is well nigh absolutely conclusive that you have a high protein corn, when you have these conditions.

MR. C. T. MITCHELL: In regards to Prof. Menges' speech about the renter and the owners of the farm, about selecting this seed

corn, it is for the benefit and a paying proposition for the renter to be very careful in his seed selection, as Prof. Menges spoke of. It will pay him more to look after his seed and the selection of his seed in order to produce a better crop. Now, then in buying a seed that is not adapted to the soil, get corn adapted to this climate, adapted to your soil. Then go through your fields, select your seed corn as Prof. Menges has mentioned, get the right height of your ear, the right stalk and you can produce your ear then after you do all the selecting. In talking about the shape and characteristics of the ear. There are ears that the rows are not perfectly straight, but the ear carries its form out to the end, and carries its seed well, and Prof. Menges says that it may not be the perfect ear, but it has the vitality to it. Now, then after you get all these points in order to raise such kind of a corn stalk you must have something back of it. You must have good soil, you must have enriched your soil. We feed quite a large bunch of stock on our farm and we try to eliminate this burning and wasting of manure which will burn white in twenty-four hours if piled up and it is no earthly good to the soil. Is this right, Professor?

PROF. MENGES: Well, I would not make it that strong. The organic matter that is contained even after the nitrogen has been burned out is of some value.

MR. MITCHELL: That is true. We went and got what they called South Tennessee brown rock, sometimes known as floats. When our stables are cleaned the manure piles are levelled off and there is about six hundred pounds of this rock spread over this manure every day. That manure is left there until spring. We plow our ground for our corn, we spread the ground with this manure, which by this time is in a decomposed state. We take our disk harrow and disk this into the ground. Then roughly harrowing; and then we plant our corn. At our last cultivation we put on about eight quarts of alfalfa and a little red and a little alsike clover. That gives us the oxygen to our soil, and this rock is analyzed by the State College of Pennsylvania as giving about twenty-eight per cent. of phosphoric acid.

THE ROAD QUESTION

By DR. McCASKEY, *Lancaster, Pa.*

When I heard that the question of roads was to be brought up before this meeting I felt rather reluctant at first to come before a body such as this, and I thought possibly there might be some remarks which might be helpful because of personal acquaintanceship with this subject at first hand. You know the value of good roads; everybody knows it. We have been reading about them for many years, and we all know what it means to be able to drive over

a road that is smooth, well crowned, hard, and that will carry us without any difficulty during the months of spring; and we also know what it means to go over a road that is full of ruts, large, deep sink holes, and with dangerous deep spots that you cannot sometimes get through at all. What we are particularly interested in, is how are we going to get them any better.

Now, there are quite a number of ways by which this matter might be considered. The other day a bill was introduced into our Legislature providing for a great sum of money to be appropriated, and for quite a radical reorganization of our State Highway Department. Well, now, gentlemen all these things are very important, and very valuable, but I don't think we want to wait until the State is going to do all of it for us. I think we can do a great deal for ourselves, and I am going to sketch in just a few words exactly what I did, and you can draw your own conclusions as to what you can do in your own township.

I live about seven miles east of Lancaster. The township is East Lampeter. I am a practicing country doctor there, and I used to have four horses, and seven years ago I got an automobile, and I followed one automobile with two automobiles, and there was a road that I used three, four or fives times a day, yellow, soggy clay in the springtime after every heavy rain. It had been neglected. There had been no attention paid to its drainage, and the first principles of road construction had been absolutely ignored; but there was the road. It had its ruts and had great big depressions, and the water after every rain would stay in the middle of the road, and every time we had a freezing spell there it would be, and in some places that road as it would come out of the springtime weather would be at least one and a half feet deep with nothing but yellow, soggy clay.

Everybody knows what that means. I used to drive this road because I had too, but I thought there was certainly some better condition we could bring about. I was paying my road taxes like anybody else and I was paying pretty heavy, and I appealed to my supervisors, and said: "Gentlemen, this road is quite heavily used and as a farmer and tax payer of this community and taking into consideration the professional interest affected, I respectfully ask if you won't do something to help me out." "Well," they said, "it is just as good as before; we always fix it in the Spring, and we will fix it next Spring." Well, things went along and nothing was doing, and I requested these supervisors to let me take them out over the road personally. I wanted them to get stuck in that rut with me and them help me dig myself out. No, they would not do that; they did not feel that it was their public duty to be particularly interested in going over the roads at bad seasons of the year, so they refused. Then I got a camera and took a number of photographs of the road in different weeks and in different seasons, and I ran the photographs over a period of a year, and the outcome of it was that as I got interested in this road subject I heard about a split road drag invented by a man named King out in Missouri, so I put the drag to work, and gentlemen, that drag worked a revelation in a few hours. I could not get anybody to drive it for me; everybody was skeptical; the drag is no good; it is a cranky contrivance, and

we won't help you. That was the general sentiment of the neighborhood. As I had sold all by horses and had nothing but my automobile, I went out on the market and rented a team. I paid my money and my neighbors charged me for the use of my team, the same people who used the road that I did. I put that drag to work and after a few hours I got the road smooth, and filled in the ruts, and a lot of the mud got into the larger holes and those too, practically filled up, and in consequence everybody used that road. And then they said, "Well, may be there is something in that road drag. We will withhold our judgment for a little while and see what it will do further." I stuck to it and dragged the road in the following Spring from the beginning of March to the beginning of May, and that road was as nicely crowned as could be, the side gutters were clean and smooth and the road was firm all over, and after every rain, instead of the mud being three to four inches deep, and having big side puddles and dangerous deep holes, it was simply an inch or two and dried off in a few hours.

Well, that worked a miracle. Farmers that drove that road theretofore would get stuck with coal teams and lumber teams and when they went to the railroad station with their oats, wheat and for supplies generally, and they would get stuck in the mud, and after dragging the road, they didn't get stuck any more. That is what I think we all can do. If any of you men are dissatisfied with the roads any more than I was and you cannot get the local officials to fix them for you, get a drag. Get a railroad tie and hitch your team to it. You have all seen pictures of this road drag. If you have not you can readily find out by writing the Public Road Department at Washington how to rig one up. Hitch your team to that drag and try it yourselves just once, within a few hours after a rain when the road is moist, but not too soggy, and see what it will do. You will be satisfied that it will be a good investment.

That is what I am getting to. The very fact that you yourself would do this sort of thing will not be looked on with favor by the men whom you have elected as your road officials. They will think it will reflect on them, and it does. It will make them active and try to get the road in better shape. They will inquire about it; they will learn about their duty, and that is really the solution of this country road problem. We are not going to get all this State aid at once. And supposing we did get a large sum of money, what are you going to do with it? We have road officials. I am one of them. The fact that we get ten to one hundred thousand dollars, does not mean that we are going to get roads faster by that appropriation. Now, the fact is that the course of things is to plan how with the dollar you are going to get a dollar's worth of work. We will learn that by studying your duty, and this is really the solution of this road problem, and as you learn, the supervisors will gradually take more interest in their duties. People are not going to fall all over themselves to work unless you want them. It is a good deal like calling the doctor at night when there is no money on hand for the fee. The doctor wants to be sure first he is going to get his fee. And as we hear and read so much about State aid and State appropriations for our roads, please don't forget that the State, while it will do a great deal, cannot do it all; and don't forget that we in each of our local townships can do a great deal.

If you want to mix up with the road officials, if they get obstinate, mix up with them. That will not hurt. See that there is some system injected into their work. Find out if they have a map of the roads in their township. Suppose you inquired in Harrisburg if there is a map of the city and the people would say, "No, we don't need any. We are going to save that expense." You would not think much of the town. If upon making inquiry of your road officials you should find there is no map of the township, how are they going to do the best work when you cannot figure out where the roads are. There is a point I want to emphasize: As you men go about the township, make inquiry of the road officials as to things of this sort, see if there is a map and if not, see that they get one! Where are they to get one? We have the State Highway Department at Harrisburg. You can get it. It won't cost the township one cent for it. If the road officials see you are talking of them and that if they don't move you are going to move them, they will move and you will get your roads.

Now, with the map you can begin to devise a local system whereby the roads that radiate into their central points,—take in my own county where the farmers deliver their milk each morning, or near a railroad center where they drive for their lumber and supplies—all these sections on that map could be well drawn and the system can be devised whereby certain sections of road will be let out by contract and the man that takes a contract for the job will be held responsible for that section. The supervisors can arrange to pay him good money and you will get your roads. Now, gentlemen, these are some of things we can do. I am not interested in this road matter any more than simply because I had to make myself interested in it for my own good. If I had not been interested in it I would have had to give up my automobiles long ago because I could not go out there. Don't wait until the State has to do all this, because the State cannot do it all.

These are just a few points in passing, gentlmen. This subject is very big. The supervisor has a great deal of authority. He is an autocrat if he wants to be. If you are blocking up a side gutter where you want to drive in with your hay team and you are spoiling the flow of water and you are damming it back you will compel that water to flow on the road, and if the supervisor comes along and says, "Mr. Jones, you want to open this ditch;" and you say, "Well, you can't open it; this is the way it has been for a good many years and I want to use this driveway, and I don't want you to open it." What are you going to do about it? The supervisor can just do exactly as he pleases. He can open it or not open it. The nicest way would be to say, "Mr. Jones, that watercourse must be opened; if you do not want to get a pipe and put it in there, let the township put that pipe in for you and you pay the bill for the pipe and the township pay the bill for the labor. Otherwise the township is going to open up that ditch and you won't have anything at all. What are you going to do." The man may say, "I am going to sue you." If he does sue he will not get anything because the law authorizes and empowers the supervisors to open up watercourses and remove any obstacles from them.

Don't wait for the State to do it all; the State cannot. Don't jump all over the State Highway Department because you have not got it already. Don't crawl all over the supervisor when he is disposed to do something besides promises. If you see a supervisor at work or out inspecting his roads on a bad, rainy day and seeing where to make improvements, follow him and see whether he makes them and if he does, back him up and you will get roads quickly with a little co-operation of that kind. There is an old proverb: "It is better to be sixty per cent. right and do something than be one hundred per cent. perfect and sit on the fence and criticize." I am for the sixty per cent. man everytime because he helps, and where I am forty per cent. wrong there is always somebody else can supplement my mistakes and we get our roads.

A Member: I was wondering why the gentleman speaking on the road question was so lenient with the supervisors. I happen to come from one of the most mountainous counties in Pennsylvania and up there we have gone to the expense of buying a stone crusher and a road scraper. They cost $2,500. We have several plank drags we are using and we have not got an abundance of taxes to work with. I think our valuation runs $320,000 for the township, and according to the law we can lay a ten mill tax, so you can figure out what we get. But the question is that the money we raise don't go to the right place, and we are not wholly responsible for that, and the only way we think is to the State come to our assistance and they can do it. Those who are from Luzerne county may have noticed in the papers this last month of the way in which our road taxes goes. I was sued and had two damage suits go to the court. We have forty-seven miles of road and have a survey map and much of that road is in such a shape that the law requires a railing for inebriated men and reckless drivers and sharpers. We have many corporate interests in our county and there is a feeling engendered amongst most of the people that it is only right to get a crack at the municipality in damage suits. As a result of that if we have a case brought up from spite work or negligence or anything we are up against it. I know of a case where a man drove off the end of a bridge because he was careless and, gentlemen, under the law, he collected damages for the accident where he should have been more prudent himself. What it costs to put up these rails we could pay with the taxes if we did not have to pay out the money for these damages and we have many miles of rails now. The law was intended for good and for the right kind of people but was abused in Luzerne county. There is a miscarriage of justice. These costs have been put on the township and the taxes have been compelled to go in that way instead of being put on the roads to do good. In Slayman township, across the river from me a man, who was an Assemblyman of this State and afterwards served a term in the penitentiary for distilling illicit whiskey, owned a farm along the river and at the height of the bicycle craze the bicycle club obtained permission of the township officials to build a bicycle path six feet wide on the edge of the bank. This gentleman I am speaking about owns a fine horse and instead of driving in the roadbed he would show his mean principle and drive in the bicycle club roadway that they had built there and maintained at their own expense. I am

getting to the point where you will take notice a bit. One day he drove too close to the edge of the bank and went down over it and then an ambulance-chasing attorney came to him and took up his case on commission, sued Slayman township for $5,000, and got $2,500 damages and that could have gone to build roads in Slayman township. We don't want very much of that up in Luzerne township. I believe that there should be some protection where there is a highway placed on the road to keep that man who is prudent and stays sober from slipping off the bank, and I do not believe there is anything better or more lasting than a sloping ridge at that side of the road that will stay there and be there for twenty-five years, and have that law repealed that makes it necessary that you put up a lot of railing for fellows who are not prudent enough to keep on the road and use judgment enough to stay on the safe side to drive.

ALFALFA IN PENNSYLVANIA

By M. H. McCALLUM, *Wernersville, Pa.*

The subject of alfalfa is quite an interesting one to me and I have had to do with it for eight years and I dare say that the last year was one of the most interesting years that I have had the experience of growing it, from the standpoint of value as a food. Now the time that I am to speak to you on this subject is very short, I have been told by the Chairman, and in the few minutes I have I shall try to confine myself only to a few of the most important phases of the subject. I should like to speak to you of its great value as a food for the dairy and practically all animals upon the farm; I should like to tell you of the essentials in the growing of the crop; I should like to speak to you of the methods of making hay; but I shall have to forget all these in order to confine myself to the limited time, and I shall speak in the few minutes that are allotted to me of alfalfa in Short Rotation.

ALFALFA IN SHORT ROTATION

I believe that the farmers are coming very fast to the time when they appreciate the requirements of a crop; that they more fully realize the likes and dislikes; and it is only when we come into this knowledge that we appreciate the value of this crop. I wish that I might be able to picture to-night in words and give expression of my enthusiasm just along this line; but this will be impossible; but I shall in a few words try to tell you of this crop in short rotation, for I thoroughly believe in it.

First of all, because of the turning down of the sod. I don't like to leave it standing longer than three years. I used to leave it stand just as long as I possibly could on account of the weeds and I have had it stand for four and five years, but I believe that the limit of time is the three years when it comes to get plowed, and it is tough enough then. It is all that three good mules can

do to turn down a good alfalfa sod when three years old. For this reason then I don't like to leave it stand longer than that. I have had the experience of turning down an older sod and it is almost an impossibility, and so on this account I do not like to leave it stand longer than three years. Then again I like to think of it and compare alfalfa with red clover in rotation, because I believe the time is fast coming when alfalfa will, to a great degree, take the place of red clover. However, I am surprised even at the present time to notice the slowness with which the farmers of Pennsylvania are taking hold of such a valuable plant as alfalfa, but I believe the time is coming, and it is coming rapidly, when it will take the place of red clover, because when we compare the value of both plants, both crops, first of all with the humus, the vegetable matter that each crop gives to the soil. This last Fall I had the opportunity of comparing very favorably a three years' stand of alfalfa with that of red clover. I went over the one field and after having plowed the alfalfa sod I went with the men to the red clover sod and I wish I just could give you the difference in the vegetable matter that is turned into the soil from the alfalfa sod as compared with the red clover sod. And on this account, the great difference, the immense amount of vegetable matter we have from the alfalfa compared with red clover is very striking.

Then again I like to have the rotation short in alfalfa because of the value that I get from turning a sod down each Fall. My method is this: In the Fall of each year I sow about twenty acres and turn that many acres down each Fall, leaving it stand three years. Now then when I turn down a sod in the Fall, for instance twenty acres, I am turning down part at least of these twenty acres with the fourth cutting. I only use about half of these twenty acres to soil my cattle up to the first of September, and in that way I have soiled my cattle up with the exception of two weeks—I am soiling sixty head—and these two weeks I might have supplied the alfalfa as well. And now I make only three cuttings for hay and the fourth cutting, one-half of it I use in feeding from about the 15th of September until the 1st of November, and if you are not going to turn down the sod you don't have that corn feed from the middle of September on to the 1st of November; because you dare not cut alfalfa in my country after the 15th of September with safety.

There is an important point in cutting alfalfa. We should not cut it, if we wish to save the crop for another year, too close to winter. And so I have this advantage when I turn down the sod I can soil my cattle up to the 1st of November, which otherwise I could not. And then I have the advantage of turning down on these twenty acres a great amount of humus or vegetable matter. I took from twenty acres this summer an average of six tons to the acre, in three cuttings. And after taking off three cuttings of six tons to the acre, I was able to turn down a sod of fifteen to eighteen inches at least, may be twenty inches; and that amount of vegetable matter with the root system that the alfalfa gives, I tell you there is something going to be doing when you turn down a substance like that. So that I thoroughly believe in short rotation on this account, because it adds to our soil more organic matter, more vegetable matter, gives more humus, and that is what we want in our Eastern soil.

Then again, I believe in short rotation because of the sod or the root system that we turn up in these few years' growth, the long tap roots that go down into the subsoil. This fall when I plowed these twenty acres of three years' standing, the plow brought up roots that had gone down into the subsoil from fifteen to eighteen inches, mind you, fifteen to eighteen inches into the subsoil, and pulled them up out of the subsoil and deposited them in the upper layer of surface soil where the shallow crops can get hold of them. These long roots puncture that subsoil, and when plowed add that plant food to the surface layer. I wish you could compare the root system of the alfalfa with the root system of the red clover. I have had results along this line. I have been able to grow potatoes and grow corn on sod that has been turned down from the alfalfa sod and, we may know something of the value of alfalfa as a food but I say we don't appreciate at the present time the great value of this plant to our soils. We have yet a lot to learn along that line; but I say the time is fast coming when we will appreciate this more. I have had potatoes upon this sod and corn and years when conditions were unfavorable I have had as high as twenty bushels more to the acre with the same tillage, the same planting and the same conditions practically all through and I could see throughout the season I was going to get better results from the alfalfa as compared with the red clover. With the little experience I have had along this line I am enthusiastic over the outcome of this crop.

I should be pleased to take up more time in the discussion of this subject and present it from the standpoint of value as a feed, because I have had lots of good experience along this line. But I am more enthusiastic now because of the results that I have obtained just along the line of the value to our soil as a soil reviver and soil vigorator, and the man who plants it should look to this not only as selecting one of the best foods for his cattle and animals, but he can stand assured that it is going to be a great benefit to his soil as well.

ALFALFA

By P. P. GHEEN, *Willow Grove, Pa.*

What is it? It is a leguminous plant, and in reckoning its value, we cannot compute its value to agriculture. We have record that it existed in Central Asia, 490 B. C. But in using the common sense view, we have no doubt that after the third day that God said, "Let there be light and there was light," that alfalfa as well as all other things existed.

From Central Asia it was carried into Greece; from Greece to Rome—to Northern Africa—to Spain; and thence to the Western Hemisphere. Its name is Arabic, meaning best fodder; and we feel that it has never belied its name.

Alfalfa in Pennsylvania and what it will do is what is interesting to us. It is only a few years since it was introduced, and behold the multitude today that stand criterions to its culture. There seems to be an unwarranted alarm that our soils are not adapted to it; that we need inoculation; that our July and August suns destroy it; that it is not worth the effort it takes to get it. We will take exceptions to any man who says it is a failure for us and prove to him conclusively that it is one of the necessary adjuncts to successful agriculture and dairy husbandry.

Allow me the privilege of another assertion, if you please, sir. That we, the people of Pennsylvania, can produce anything that will grow in a Temperate Zone as good as can be grown in the world if the right man is behind the gun. We don't turn our backs to Kansas for bushel corn, nor the Dakotas for bushel wheat. Neither to any other place for any product of the soil in quantity or quality. More than that, we have within easy success four of the best markets of the world.

The question has been asked many a time to my knowldge, "What piece of ground shall I select to grow Alfalfa?" Select ground of an upland nature with good natural drainage, sandy sub-soil that is not water-logged, and various other instruction that the average man would forget one-half of before home was reached.

The following question: "How shall I prepare my ground for the seed?" They would be instructed to plow, harrow, disk, roll, etc., not called for in any sense whatever to the average intelligent farmer. Then it would be followed with the third question: "How shall I fertilize?" Lime abundantly. Fertilize with complete fertilized lime the second year, etc. until the instruction the applicant had received would seem of such magnitude that he would abandon the project of alfalfa culture forever.

If you contemplate alfalfa culture in the short way, permit me to explain how I have seen successful results. Select from your soils any piece of land that you know will grow common red clover, and it is a fact that where one will grow so will the other.

In your selection you can take any piece of land you think is not giving the proper return from prior crops, plow and cultivate thoroughly by July 15th. It is very necessary that this should be thoroughly limed with fresh slacked lime at this time, following with thorough cultivation until August 10th. If you will treat your land liberally to cultivation before seeding, it is a plant that responds very quickly and you will reap handsome returns from the expenditure you have made.

With your permission I would like to say something in reference to cultivation of any crop at this point. Is it not a fact that we people, meaning farmers, attempt to do too much with too little. It is very vivid in my mind that our soils are like the college man's brain. You take the average college man, load his brain to the uttermost. Grant his diploma and turn him into the world to earn a livelihood at the mercantile business. What will become of all the scientific training that brain has had? To a great extent it will diminish and fade away, profiting the world nothing. Where, on the other hand, if that scientific training is cultivated it will expand to the credit of the individual, showing the world the necessity

of cultivation. It is just as necessary for us to cultivate our soils to the uttermost, that the fibrous roots of the plant-life may permeate every part of such that we may derive the whole benefit contained therein, and reap handsome returns therefrom besides the satisfaction of mind that the work was well done.

Returning to my subject: Be careful in the selection of your seed. Make the attempt to sow on August 15, or as soon after as possible, at the rate of eight pounds alfalfa, eight pounds common red clover to the acre, sown with broadcaster and harrowed in with a sixty tooth harrow. Sow fourteen quarts of timothy seed the opposite direction. Treat likewise with the harrow. The following year you will have red clover and alfalfa first crop; then two cuttings of alfalfa. The next year first crop you will have a fine stand of timothy. You now have your ground inoculated ready for alfalfa alone. If your red clover fails at the sowing, so will the alfalfa. The bacteria that cultures red clover cultures alfalfa. Too much cannot be said of the value of alfalfa. They are to be divided into several classes. The feeding value of alfalfa is about on the same basis as winter wheat bran, containing twenty-seven per cent. Protein. This value needs no explanation. The second value is nitrogen-gathering properties leaving the soil in a better condition each succeeding crop, depositing on its roots through its leaf surface the most expensive fertilizer known to agriculture. The third value is the amount of nitrogen gathered in proportion to any of its sister clovers. The leaf surface of a thrifty stalk of alfalfa is about double that of common red clover. The fourth value is the excrement from alfalfa fed stock contains about double the amount of nitrogen, potash, phosphoric acid as that from other fodder or hay.

Its fifth value is that once a stand is procured you need have no concern for at least four years. Its life is about double the time of average red clover as its life is two years; about four times the life of Alsike. Thus it is a great labor saver in this respect. Its sixth value: You rarely see noxious weeds in a field of alfalfa. The constant cutting it will stand destroys other plant life. This point makes it very valuable. I have in mind a field ten years ago with an excellent stand. Garlic sown to alfalfa and resown in four years.

The garlic at this time is gone and everything else of noxious weed kind.

It is not worth my while to tell anything more of its feeding value; but, I will state one thing accomplished in the summer season of 1909. The party had a dairy of eight cows. The drought began June 15 and lasted until the alfalfa season was done. By good feeding of green alfalfa each day from June 15 to October 15 the product of that dairy was increased $1,980.00 over any other year they were ever in business corresponding with the same period of the corresponding year. With your permission I will state another feat accomplished with green alfalfa. In the Spring of 1910 I saw chickens fed on Otto Weiss Chick Feed, sour milk, cut short green alfalfa make two and one-half weight in sixty-three days, with chickens worth forty cents per pound.

These are facts and not idle talk, for I know whereof I speak. And if the gentleman who tries alfalfa and fails the first time will

keep these few lines in front of him, commit to memory and report to his neighbor, they will sound like this and he will try again.

"If you strike a thorn or rose,
Keep a goin'!
If it hails or if it snows,
Keep a goin'!
'Tain't no use to sit and whine
When the fish ain't on you line,
Bait your hook and keep on trying,
Keep a goin'!"

I have seen horses leave No. 1 Western clipped oats to eat second crop alfalfa. The animal can tell us which is best. I have seen dairy cows leave No. 1 Buffalo Gluten to partake of green alfalfa. In fact, it is feed for the soil, for the animal, and for the owner's bank account.

In conclusion, I would encourage any man who owns ground that will grow common red clover to begin with alfalfa at once, and after he has harvested his first crops and burned the following winter's fire wood, it will not take an uncultured farmer like myself to explain the advantage derived therefrom.

COST OF MILK PRODUCTION

By A. B. HUEY, *Lenape, Pa.*

Being asked to say something to you on Cost of Milk Production, I will first quote from the Thirtieth Annual Report of the New Jersey State Agricultural Experiment Station, New Brunswick, New Jersey, for the year 1909. Their cost for maintenance would be practically the same as ours, their cost of milk in cans at the farm is .0416 cents per quart. This is for actual cost of feed consumed and labor expended. It does not include anything for supervision, investment in the farm itself, dairy buildings, neither apparatus, milk utensils, incidental expenses, or insurance, and with cows averaging 8,561 pounds of milk per year. I will consider this cost of milk production as that of the average farmer who raises the greater part of his own feed, and markets it through the cow. What can he do to cheapen the cost? In many instances where he has made a competency, he had done it either through more than ordinary judgment, or the strictest economy and hard work, often drudgery.

This reminds me of an instance where a farmer had bought a few cords of wood from a neighbor. When the farmer came to settle he mentioned the fact that in coming out with the last load two or three sticks had fallen off, and as he had on a heavy load he did not get off to recover them. He would therefore just take five cents off the bill. This man did not make that five cents he only saved

it, and so many milk producers are doing just as this man, only saving by the closest economy, which in most instances either is taken out of himself or some of his family. While I think it is often as important to learn how to save money as to know how to make it, I do not like to see the line too closely drawn, and I think that every producer when he comes to figure out for himself whether he is making any profit in the production of milk should take into consideration this labor account.

Having decided to go into this dairy business, one of the first things to consider is, how can I keep this cow profitably? How can I handle her milk satisfactorily, and how can I know a profitable cow? What shall I raise, and how can I handle it at the least possible expense?

Before buying the dairy herd, build yourself a silo preferably of stone. Some kinds of silos are better than others, but any one is better than none. Not that more milk can be made with silage than with concentrated foods, but it can be made at less expense. Prepare yourself with a crop of any variety of corn, whatever will raise the most corn per acre in your locality, and do not make the mistake of so many and raise your corn too thick. I think it is clearly demonstrated that corn will not do well in the shade of a tree, and just in such proportion will it not grow in the shade of itself. Good corn, well eared, fully glazed and husks commencing to dry, just in proper condition for silage, wil be one-third total weight of ear alone. How can we expect a fodder to take the place of feeding value of ear. Actual weights carried through a series of years and with different kinds of corn have always shown the fodder in weight, not bulk, to equal or exceed that planted thicker, and always an excess of grain.

Do not be afraid of the stalk or ear being too large, as you can prepare yourself with a cutter that will handle them. Cut this corn as low to the ground as possible, thus doing away with any long stubble in seeding, and loss of valuable feeding matter in stalk. In the handling of corn from field to silo, many farmers add unnecessary expense, first by not having low down wagons to haul this corn on, and second by carrying or turning it half around to get it upon the cutter. At the end of elevator or blower pipe, always have a hopper with a funnel hanging to it, and made in sections to injoint as you go up, to carry corn from hopper to bottom of silo. This always insures an even distribution of your corn, avoiding all mould spots, caused in many instances by throwing bunches of leaves in one place, as is often the case in leveling with a fork. This shute always saves one man, as the person who carries it can both distribute evenly and tramp at the same time. I always advise the ramming of silage as getting it denser, thus avoiding all air spaces possible. Silage may be spoiled by leaving too much air in the corn in filling as well as from outside air. Just here I will say that a poor silo properly filled is better than the best stone one carelessly filled. Good silage should always be cold after the first heating has gone, as this second heating is the first stage of decay and should never be found when the work is properly wet and rammed. There has been quite a bit of experimenting in order to find something with more protein in it than corn, that is adapted to silage

purposes, but all things considered I know of nothing so satisfactory as corn.

A great many are turning to alfalfa for protein, and justly. I must advise you to try alfalfa, since in many sections of the State alfalfa seems indigenous, and there is little or no trouble in raising it.

I suggest from my experience and observation that you can raise it anywhere if you will carry out the following: I prefer fall sowing, by this I mean August. Not that the alfalfa will germinate better, but on account of weeds smothering it out in the spring.

Have your ground deeply ploughed, with no vegetation to harrow up. Spread thirty-five to forty bushels of lime per acre or 1,000 pounds of ground limestone and 10 loads of well rotted manure per acre on this ploughed ground before cultivation for seeding. This manure makes a mulch for seed germination which in no instance should be neglected. I believe in inoculation, where it is needed, and you can tell by the light sickly color of the plant if such is the case, the proper way to secure inoculation is to plough up this same piece of ground each fall after second cutting until you have it.

Perhaps you have ground adapted and merely need a better stand. This can possibly be as well obtained by harrowing the ground deep after second cutting and reseeding. You need not be afraid of harrowing up the alfalfa or of covering it with dirt. I have seen a better stand apparently from the sprouting of the roots where the ground was ploughed than before the ploughing was done. In my section we have as yet used the hay cap but to a limited extent. For the first cutting this is a necessity. The alfalfa where clear of weeds may be put in small hand stacks with little or no wilting. These stacks every other day should be moved by two persons upon opposite sides, slipping them sidewise to fresh stubble. You need not be afraid of even the thinnest muslin hay cops, as they will turn the most severe weather and are no experiment. With an abundance of good corn silage and alfalfa hay you are as well prepared as you can possibly expect to be to keep the cost of milk production low as far as maintenance is concerned. What I have said in regard to alfalfa is equally applicable with our red clover, which makes a very good feed, and it or alfalfa is almost indispensible. While I have never done any soiling with alfalfa, some think it has no equal for that puropse. Both with alfalfa and red clover the most common practice is to let them get too old before cutting, a mistake which should be avoided.

Barns need not be expensive structures to insure health to the cows but plenty of light with good ventilation is always essential. Where you are remodeling any barn it is a mistake not to prepare for ventilation. Do not place in the stable a lot of wooden stalls, which will never score high. Sanitary inspection is sure to come, so build with this object in view, and do not fret if you have been so short sighted as not to meet its requirements. Stanchions I have no use for farther than it is possibly the cleanest tie known, yet nevertheless I would discard them on account of their being too confining for the very best results.

A gutter behind cows or a platform upon which the cow stands is advisable. As I always think an ounce of prevention is better

than a pound of cure, I would in no way neglect the clipping of the hair from the thighs, flank and sides of the cow in fall before stabling. This is a precaution in cleanliness not to be neglected.

The matter of something to wear both for the protection of your own clothing and from a sanitary standpoint is a perplexing one, and naturally to the initiated suggest white—yes white suits to milk in. That reminds me of what happened once when I went to inspect some dairies supposedly expected to wear white. In going through the barn I espied a nice closet with doors standing open. I suppose I looked rather closely at it as I passed, as the information was volunteered, that is the closet where we keep the suits, but they are at the house being washed. Friday noon, rather a peculiar time, unless washed every day, which was hardly likely. Another pause, when he said, to tell the truth it is too damned hot to wear them. I admired this truthful statement. I have never seen anything more satisfactory than a bib apron similar to a cobbler's. It is made with a plait in the bib so that from the vent down it will lap about two inches and come below the knees. Always avoid loud talking or noise calculated to make excitement in handling cows.

For the ordinary dairy, no manner of straining milk is quite as efficient as to have the common wire strainer bucket into which to pour the milk from the milking pail. This strainer removes any foreign substances which may have got into the milk. This bucket should be rinsed often when needed. I would strain from this bucket into a second wire strainer covered with two thicknesses of cheese cloth, and after cooling, pass the milk through a square of ordinary grade of canton flannel. I heard before this body last year the use of strainer cloths the second time condemned as unsanitary, because not likely to be washed clean. There are so many other things besides strainer cloths requiring cleanliness that where a person cannot wash a cloth, I would condemn him as not fit to have charge of the cleaning of any of the dairy utensils. Some people cannot see dirt.

A milk cooler is an absolute necessity, and in nine cases out of ten, is bought too small to get the best results. Philadelphia has just announced the requirement of a temperature standard of 60 degrees Fahrenheit, with a possibility that in a short time this temperature will go even lower. This will result in all small towns requiring milk to be cooled to a corresponding temperature. To meet these requirements successfully it is going to be a necessity to use ice. Preferably an ice and milk house combined. Undoubtedly the ideal situation for a barn or stable is a southern and western exposure, and one should never build anything on these sides to obstruct the sunlight. Our prevailing winds here are westerly, so we should wherever possible go to northwest corner of the barn for a milk house, and if you have this northern exposure, the milk house need not necessarily be taken far from the barn. Your ice house only for the convenience of the vault need not be near the milk house. Where you have the combination of the two together it makes the ideal way of taking care of milk that will meet all requirements. and with the minimum of expense. Your ice house should be built with a vault under it large enough to accommodate what milk you produce. On top of this vault should be a system of pipes with the ice resting on them. Two essentials are necessary, a supply of

cold water on hand to run through the pipes, and the pipes so arranged that the ice will not arch. With such an arrangement you can be reasonably sure of drawing water at 36 degrees cooling milk to 40 degrees. The temperature of the vault in which to place the milk until shipment should not be higher than 42 degrees.

Some years ago the Dairy Division at Washington sent a man to make inspection and report upon a prominent creamery firm, as to why they were enabled to get more than an ordinary price for their butter. The report said that the superiority of this butter depended to a large extent upon the ability of the firm to find buyers to buy it. In my own observation there were two other reasons: Its absolute uniformity in texture and its splendid keeping qualities. These were due in no small measure to the care and cleanliness in its production, and the attractive manner in which it was always packed.

Can we educate ourselves to judge a profitable cow? Yes, to some extent, but we older ones will have to turn our education in another direction and make a positive record of her production before we can expect to succeed. I find many instances where even daily tabulation of milk production is made and the owner does not find time to make out the yearly record. The man who thinks he can know the yearly production of any of his cows, with their butter, fat and feed record, without keeping an actual record of same, is under a delusion, and might as well try to keep in his head the account of the money paid his hired help. This work is a positive necessity, and if one does not find the time to do it himself he should turn to a cow testing association, by which in the majority of cases it can be done more accurately and cheaply than by the farmer himself has a variety of other interests to look after.

Is not the fact significant that where Wisconsin with 998,000 cows has twelve cow testing associations, Pennsylvania with 943,000 cows has but two.

Michigan with 563,000 cows—six cow testing associations.

Maine with 173,000 cows—seven cow testing associations.

Vermont with 107,000 cows—nine cow testing associations.

I take notice that outside of the corn belt, they have been compelled to look for things to cheapen the cost of milk production, and naturally turn to the silo and dairy testing.

Just in the same proportion as the cost of this milk depends upon the little things that have to be done every day, so does the yearly record depend to as large an extent upon the persistency of a cow milking, as upon her to giving a large amount at the time she freshens.

The yield per cow must not be guessed at. The average per cow, census of 1900, for Pennsylvania is 5,160 pounds per year. Generally speaking, the cost per quart of milk increases as the amount produced decreases. In other words, a cow giving 10,000 pounds of milk per year, will produce milk cheaper quart per quart than a cow giving 5,000 pounds.

In any case, low producing cows are expensive milk makers, and must be ousted from dairies where profits are made.

Successful dairying depends upon the quality of the cows kept, that is their individual producing capacity; upon the ability of the dairyman to grow on his own farm the bulk of the feed consumed and upon the application of business principles to the industry.

COST OF MILK PRODUCTION—Continued

By GEORGE ABBOTT, *Philadelphia, Pa.*

My first-hand contact with the production of market milk ceased nearly forty years ago, but my relation to the subject from the standpoint of the retail dealer has continued, and has afforded ample opportunity for observation.

In the field of butter making, the buying of milk by the fat content, and upon market quotations, effectually disposes of all questions as to values, for the law of supply and demand is inexorable. Not so with market milk, and we suppose that it is this that is now primarily under consideration.

The failure of the corn crop throughout the United States in the year 1907 greatly accentuated the already steadily ascending price of all animal products, based as they are upon the cost of feed stuffs. Beef, mutton, pork, butter and cheese advanced in price by leaps and bounds. In Boston, New York, Baltimore, Washington and Pittsburg, the price of milk advanced somewhat in sympathy with these conditions. This advance was as natural as the law of gravitation, and Philadelphia would have participated therein had natural law and sequence held. But there has been no advance in the retail price of milk in Philadelphia; it is furnished the consumer at the same price as it was eight years ago, and it is furnished below cost. As a result of this condition, the producer of market milk in eastern Pennsylvania is selling his product at an unreasonably low price. Speaking roundly, the advance in the price of feed stuffs has been from 25 per cent. to 50 per cent., and the advance to the consumer in the animal products above recited, except milk, has been about 25 per cent., and in the case of milk in all cities but Philadelphia about 12.5 per cent.

As a general statement, milk has advanced from eight cents per quart retail to nine cents per quart in the cities of the East, excepting Philadelphia. The dairy farmers supplying these cities are receiving about all of this advance of one cent per quart. The retail milk firm with which I am connected has for many years kept books in a way that gives close tabs on the cost of distributing milk, and the margin of profit in its sale. We have found this margin to be from a quarter to a half a cent per quart. The milk dealers of Philadelphia have for three and one-half years past paid the dairy farmer about one-half cent per quart more for milk than in the previous years, thus consuming all our magin of profit. Besides thus giving up his margin in the business to the dairy farmer, the retail dealer has been and today is confronted with a constantly growing demand for large expenditure for the hygienic handling of the milk. Thus the dairy farmer supplying Philadelphia with milk is receiving a half

cent per quart less than the suppliers of the other cities of the East, and the Philadelphia milk dealer is being ground to powder beneath the upper and the nether mill stone set by these trade conditions.

No sensible person will claim that this is a reasonable state of affairs, and no honest consumer believing in fair play between man and man, will take satisfaction in the one cent per day that each family is saving at such unbearable cost to those who supply them this common necessity of life.

But the general public is unreasonable. The average man is selfish and unfair. He will boast of the price paid for an oil painting, an automobile or a phonograph, and at the same time boast of the low price at which he has secured his transportation, coal, bread or milk—the common necessities of life.

The Philadelphia newspapers are largely time serving, bidding for popularity, and the temptation to take sides with the unreasonable and selfish portion of the community has proved to them irresistable. For twenty years past, different newspapers of Philadelphia have from time to time made attacks upon the purity and excellence of the City's milk supply, and to this in measure we believe is due the fact that the use of milk is so small,—only a half pint per capita.

No one claims that the general supply is perfect, neither that is is as good as it should be, but had a spirit of fairness or an honest wish to improve conditions prompted these attacks, there would have been encouragement for efforts towards that end. But the slogan has ever been, "Down with the price!" "Down with the milk dealer!" And this although great pains have been taken to convince them that milk is no exception to the general rule, and that a fair price must be paid for a good product. When in 1907, a prominent Philadelphia Daily unscrupulously and virulently attacked the milk trade to prevent a just and equitable rise in price, unfortunately the Milk Shippers' Union was officered by narrow-minded, vindictive men who entered into a conspiracy with this prominent daily, and for two years opposed every effort to raise the price of milk at retail. Under such an attack it was but natural that a large portion of the consuming public was aroused and quickened, and a state of mind engendered that would wreak vengeance upon any dealer who ventured to ask an increased price for milk.

Meanwhile, Philadelphia's Department of Public Health is feeling the pressure of the nation-wide movement for a more hygienic milk supply, but they cannot apply the requirements in force in cities where a reasonable price is paid, for fear of precipitating a milk famine. Dairymen will not bestow the expense and care requisite for the production of hygienic milk when they can just as readily drive to the door of the butter factory and receive as much for the product, and no questions be asked.

What is the remedy for this unreasonable and discouraging condition? It takes months to build a good barn and to fill it with the products of the farm, but the fool or the vicious can burn it in an hour. The damage to the milk trade is great and it will be hard to repair. The regeneration of those responsible for its undoing seems the first step for relief. The Milk Shippers' Union seems to have recovered in measure its sanity, and there is a little breaking, as of dawn, in the mental horizon with the benighted newspapers.

MR. ECKERT: It seems to me in listening to these discussions that one of the things that leads the average farmer who has not been in the habit of doing these things astray is the air of difficulty we throw around these different feed problems. I may be wrong, but that is my impression. At our farm the method has been that followed by Mr. Huey, having one pound of grain to three pounds of milk. Sometimes the farmer thinks you have got to weigh the grain every time you give it to the cow. We make up a balanced ration of grain which we don't change during the year. We have a box made that holds exactly two pounds of this grain, and then we string a wire in front of the cows on the feeding alley and we have a board which are tacked cards that have the figure 1, 1½, 2, 2½, 3, 3½. I can take a foreigner into the barn and show him the box and the figures and he puts in so many boxes to each cow as indicated by the figures on the cards at their stall. We change these cards every two weeks. If the cow is dropping from 35 pounds of milk to say 30 pounds, she is reduced in proportion, so just as the cow begins to go back on us we begin to go back on her, and when she gets down close to the period when we ought to dry her up we start to cut off the grain entirely until the cow is dried off completely. As soon as she is dry we start to feed four pounds of bran and one pound of linseed to meet the requirements Mr. Norton talks about, to put in good condition for maternity. It is wonderfully easy. Don't imagine that systematic feeding is a difficult proposition if you have some simple method like that. That is our way. It is an easy matter to have an entrance in the barn with the cords with the figures on and for sixty-five cows I can change all the numbers in a half hour. To be sure, I must know how much milk the cows are giving, but I take the milk cards and go through the barn and see what the cow has been giving and tack up a card to suit the requirement. The simplicity of the thing and its effectiveness is what I think should be impressed on any man who is interested in making the feed go as far as possible. You won't have a cow go wrong on you, except once in a while you will probably have a cow that gets a little better in flesh than the rest and then we give her less corn meal. That is the one variation that we make, and our herd is running close to 7,000 pounds; we have got a number of heifers in it and we think that is fair when the feeding is done mechanically.

MR. PHILIPS: I would like to say a few words along this line. It has been my experience in going around dairies and seeing the feeding done, that the best results are obtained by the ordinary farmer where he is in close touch with the individual cows, and where he does not intend to feed in proportion to the milk given. I think our larger records are made in that way, and the man doing his own work is generally in close touch with each individual cow and can feed that cow necessarily better than by set rule. I know these are some cows can make milk on less feed, because they will make 5 pounds of milk to every pound of feed they are getting; and by grading up in that way we are in close touch and I think the best results are obtained. I have told farmers that they could not pick out the best cows unless tested and I believe it is true. Mr.

Huey said in regard to feeding cows that sometimes the cows we thought the best were the poorest. When I started feeding cows I did not get far until I found that I was not getting what I wanted. I got a work on pure bred cows and learned more about cows than I thought was in that. I believe the salvation of the dairy farmer is the raising of his own cows. I think that at the prices cows are now he can raise them cheaper and get some that will do him good; but if you undertake to go to the cow sale you must get anything you can and tuberculosis or anything else with it. The question was asked whether there was any section where they are raising dairy cows for sale. I don't know that they are raised especially for sale. I was out in Wisconsin last fall and learned that 700 car loads of dairy cattle were shipped out in one week and 250 grade Guernsey bulls in another one. I know a man in Des Moines, Iowa that buys car loads and car loads of cows in the section around Philadelphia and sold him some. Common cows sell out there for as high as $140. He offered me $100 for a common cow last June which was 12 years old. These are the prices that western men are up against. What are the eastern men going to do if they don't raise their own cattle.

The Mayor of Philadelphia has appointed a committee to look into the sanitation of milk and they are about ready to turn in their recommendation. The milk dealers wanted them to recommend pastuerized milk but they would not do that. It is a simple way of covering up all the dirty milk they are getting and getting it off their hands.

There is a movement now to change the testing of cattle for tuberculosis and I don't know what that will do, but it is being strongly advocated to make it so that every transfer of ownership of an animal must be accompanied with a tuberculosis test and in that way insure healthy cattle. It is important to profitable milk, and by requiring such a test we are bettering the farmer in the end. I have not found a single man that has tested his cattle, who has not been well pleased after he got started again, while entire herds have been lost too.

I think this discussion leads very largely along market milk; that there has been injustice done all along to the producers, and that they have not received what they should for their milk. I feel that this is one of the ways to get better milk. It has become so in the market that people have to buy anything. Skim milk is added to cream and sold as cream contrary to law and the milk is kept as long as possible by pastuerizing or kept with preservatives. That is done to the detriment of farmers like us, and they take a half a cent off the farmers for the whole milk. This is working against our farmers. I think something should be done to remedy that practice. There was a time here this fall when more skim milk was going into Philadelphia than whole milk.

MR. SMITH: I did not come here with the expectation of making any statements, still I have a few figures. I have been keeping a record for some years back with my dairy. In fact, I started some 15 years ago with a grade Guernsey cow I bought for $30.00 at a sale and from that cow I graded up, always using a pure bull, until last year I had cows making a record of 456 pounds of butter fat per

year, one cow; and as well as making good butter fat this year I have six cows that in nine months gave me about 6,000 pounds of milk apiece. I have just a few figures. They only run over nine months; this year's record beginning April 1st and continuing to January 1st. Probably the part that would interest you the most is that my commercial feed in that nine months for fifteen cows has cost $380.00, or $25 1-3 per cow for nine months; that is, commercial feed. In addition to that I am feeding ensilage for half that time probably, and the cows are on pasture the rest of the time, feeding some with hay and second crop hay. In my year's work, in counting the feeds of the cows if I put so many loads of hay or second crop hay in the mow I charge it to the dairy. I don't weigh what they eat each day or each feed but it shows the year's work in that way.

As to milk testing associations, I have two cows that have been tested since the 1st of April for the advanced registry and the tester that comes there is required to be there two days. While he was there I made use of him in testing all my grades, and in that way I think I can keep a pretty correct record of what they are doing. I have not the record with me but in that nine months from fifteen cows we have churned and put to market 4,292 pounds of butter. In giving the dairy average for the butter we don't give that average for the full price we get. The highest price we average is 37 cents while at the retail market at Philadelphia it is bringing 43 cents. The lowest price has been 32 cents. Last year's work, after counting all the feeds we raised ourself and the commercial feeds that we bought and charging the labor and also giving credit for the manure, my profits were $50.00 per cow. Last week I had the tester there. The lowest test in the herd was 490 for one cow and the next lowest was 520 and I have cows running from that on up. I may say the cow I bought for $30.00 and started with was from a man who was selling Jersey and grade Guernsey. He brought a sample of milk from each cow to Philadelphia to have tested so that he would know which cow to sell and this was the highest test in the flock. He thought she did not give any milk and he would not keep that cow so he sold her to me. Her offspring, children and grandchildren and great grandchildren have all been testing 5 and over right along. In fact, a granddaughter tested last week, when milking ten days only, and her test was 5.30. She was a heifer with second calf and at that time giving 28 to 30 pounds of milk a day and had only freshened ten days before. I think it is an advantage for dairymen to raise their own stock, as I have proved conclusively in my own case and, of course, we have the skim milk there all the time to feed the calves. We feed on skim milk until four months old. I may add further, I have been feeding six heifers in addtion to my milk cows, I simply feed the heifers—so that three heifers get about the same amount of feed as one cow. I have not been following it closely because I don't know how many pounds of milk the cows are giving. In other words, I feed for butter fat rather than milk. Some cows not giving as much milk give more butter fat. That is what I am after and feed for and in my feeding operation I try to feed a cow such a ration as will keep her in average flesh; if laying on flesh

faster than she ought I cut down or if losing flesh I add a little fat to the food.

PROF. VAN NORMAN: I would like to add to this discussion a little bit by emphasizing two or three things in connection with this discussion on the cost of milk production. It was brought out right here this morning and it is brought out repeatedly in different meetings I have been to and by different men I have met, that when you find a man who don't spend all his time with a sickle, shovel and pitchfork, who is not kicking about the high cost of milk and no profit in farming, he is getting some accurate figures. You find a man that has demonstrated that he can produce at a profit. The lesson I get out of that is this: that the only salvation for the dairyman today is for him to be so constituted that he will get accurate figures on what he is doing. If he is so constituted that he cannot get figures I see absolutely no hope for him, because I never yet heard in meeting or out of meeting, of a man that has been making a big profit who cannot give figures. One of the things we learn in the educational work is to think, and I find that the fellow who thinks can argue forward or backward from a given point and I argue this way, that the men who are making money always have figures and the fellow that cannot make money rarely has figures. There must be some relation between figures and money, and I say the only salvation I see is for the men who are getting at this thing is to figure. When he does get to figuring he is going to find out a few things. One of them is that some of his good cows are only giving from 3,000 to 4,000 pounds of milk a year and there is no question about it that you cannot make a profit on a cow that gives but 3,000 pounds of milk a year, in any market in Pennsylvania today. There are not many in the State of Pennsylvania having a few cows producing 4,000 pounds of milk a year can make a profit on those cows if they charge up the labor.

The other thing was hinted at but not emphasized as I hoped. One said that it cost very little more to produce a crop of silage that produced twenty tons per acre than it did to grow one that produced but ten tons. In that truth, gentlemen, is the foundation of profit in all farming, and in the feeding of the cow. It takes the first tons of silage to pay for the labor and it is not until you get more tons of silage to the acre than will pay for the labor of growing the corn that there is any profit in silage ,and the same is true of the cow. It is not until she has produced milk enough to pay for the feed and labor and interest that there is any profit in the milk, and that takes more than 4,000 pounds. A representative of the Borden's Condensed Milk Company recently told me that they have figures of the milk production of over 4,000 farms in the State of New York. I think it was for the last twenty years. They know how many cows have been kept on those farms; they know what the average production per cow per farm is on the farm that supply them. That is the way the Borden Company makes money, by having the figures and knowing what they are doing. They know their business and their farmers' business. Not only are they able to fix the prices but see what the farmer can do because they know more about it than the farmer himself. They see that on those farms

where the average is over 6,000 pounds per cow per year the farmers are making a reasonable profit and are reasonably satisfied and contented and going on with the production of milk; that on the farms where the average is less than that there is not only discouragement and dissatisfaction but they are actually going out of the milk production business so fast that the Borden people are troubled to know where to get the amount of milk needed to furnish their customers in New York City. They can sell more milk in New York than they can get; therefore their problem in New York and eastern territory is to get milk enough to meet their trade and they are limited because lots of the producers are going out of the business because they are not making a profit and the reason is that they are keeping poor cows. And so I say to the Pennsylvania farmers that I believe that the solution of this proposition is in first-hand knowledge of what we are doing, because there are cows that will make a good profit at present prices, and I would not be a bit surprised if you will find that often there is actually more profit on the best 30 cows in a herd of 50 than there is on the whole herd. There are lots of men who will find they have been supplying the trade for glory instead of profit, and that while not selling as much milk from 30 cows as they did when they had 50 cows they would be much better off with the best 30. Get the facts. Somebody has got to supply the trade with milk from somewhere. What we are after is profit. That is what we have to have. There is many a fellow when urged to have his cows tested will say: Then I will have to sell my poor cows, and not have enough milk to supply my trade. That is the argument over and over. It may be he is under obligations to furnish a definite number of gallons of milk. I would cut out that obligation quick if I could not meet it and make profit, better make less milk and keep fewer cows and have a profit left. The only way is to get the figures of how much the cows are producing and what we are paying for the feed and labor. This feed proposition—the first thing you have to do is to keep the cow alive and it takes approximately the same amount to keep each cow going. After that all the good feed you can get a cow to eat up to the point of getting fat goes into milk production and if you have got a cow that eats three times as much over maintenance as another cow she will make three times as much milk, but if the extra feed goes into body fat it does not count in the milk pail. It is the quantity of silage raised over and above the cost of labor on it that makes the silage cheap food. It takes just as long to feed a poor cow as a good one; as long to haul the manure out from a poor as a good cow. We have got to get a surplus over and above cost and the place to commence to figure these matters is at home. A great many farmers in Pennsylvania do not take time to consider. What we need on many farms is to get one more farm hand even at the prices you have to pay today and then let the owner spend five hours a day using his wits and let the farm hand to do the work he would do with his hands. That farm hand may cost 50 cents or maybe a little more, but the man who is feeding thirty or forty cows will have time to use his wits and an hour spent in watching the men plowing or feeding or in studying the cows, or how to save time for the other

men will earn several times 50 cents. He will study the amount of time to do the chores, see to getting the maximum amount of results in a given number of hours. That is head work and few men can do that head work and do a day's work with their hands also. There are farms where it is not practical to do this, but many where it is and the man who can do it can make money and profit by producing good cows and selling milk at present prices and can make a large individual volume of milk from the cows he keeps and not dilute the herd with the poor cows. The cow testing association is simply a book-keeper hired to do the figuring which you often cannot or do not wish to do. We cannot successfully conduct any other business today without a book-keeper and we must keep strict account in the dairy business also. I want to emphasize this point, that it is business methods and exact knowledge of detail costs we must have to be successful.

REPORT ON MILK AND CREAM EXHIBITS

By PROF. A. C. KELLY, *Washington, D. C.*

Ladies and Gentlemen: I am sorry that I have not been able to report on these milk and cream samples before, but milk and cream are not judged as easily as butter is. It takes some time to do this. I got to town Sunday night and, commencing Monday, I have been working on the milk and cream samples and just got finished this afternoon.

Now, we have had up stairs fine exhibits of corn and fine exhibits of fruit, but I want to say that the man who exhibits good clean milk, or rather the man who produces on his farm, good, clean milk is one of the most useful citizens in his community. Now fruit we may regard partly as a luxury, but milk is an absolute necessity. Milk is used not only for adults, but it is the sole food for a great many children, so that the man who produces clean milk is not only a useful member of the community but a true scientist, so many things enter into the production of clean milk and good milk, chemistry and bacteriology, that the producer of clean milk is a scientist.

Now, in the certified milk class the farm scoring the highest rating was the Willow Brook farm, at Willow Grove, where they scored 96¾ points. In the market milk the highest rating was scored by the Pencoyd Farms, with a score of 96 points out of a possible hundred. The second place, or those receiving honorable mention with milk, and that means a score of over 90 points out of a hundred, were S. E. Morse and Son with a score of 94, J. L. Balderson with a score of 93¼ and J. R. Kendig with a score of 90¾. In the cream, the man having the highest scoring cream in the contest was S. E. Morse and Son with a score of 94 points out of a possible hundred.

Now, may I have a few moments to explain the method of scoring? I have here some of the milk that was entered in the contest. There

is the certified milk that won the first prize. Here is the market milk that won first place; and here is the market cream that won first place.

Now, the keynote of all these meetings this week has been quality. Milk is one thing in which the quality has been neglected for a long time. And what do we mean by quality in milk? Some people may say, the amount of cream or butter fat—I have heard people passing the exhibits up stairs and looking at the cream around the top of the bottles say "That is fine milk. Look at the cream on it." We know now there is a great deal more meant by the word "quality" as applied to milk than mere composition. We know that cleanliness is of prime importance. There are two reasons: first the sentimental standpoint, and second what I call the economical standpoint. The sentimental stand point has to do with the danger from disease from dirty milk, but I won't touch on that because our time is so limited to-night.

The samples are scored on a basis of one hundred points: 35 points are allowed for bacteria; 25 points for flavor and odor; 10 points for fat; 10 points for solids not fat; 10 points for freedom from possible sediment in the bottom of the bottle; 5 points for acidity, and 5 points for appearance of bottle and cap. I just want to run over briefly what goes to make these points. First of all the flavor and odor are influenced by several things. They are influenced by bacteria. I have a sample here which any of you that are interested can smell after this meeting is over. That has a very putrifactive odor. Here is another sample. This has a clean sour odor. This has a different class of bacteria working in the milk and bacteria govern the different odors before the milk is sterilized. This one here has a smell that comes through feeding bad silage or feeding at the wrong time or way. The time to feed silage or any other feed of that kind is right after milking and then the odor has time to be distributed before the next milking. Care should be taken when the feeding silage to sweep up all that is scattered about after the cows are through and never leave any silage about the barn.

The question of bacteria,—what are these bacteria? They are little spores and they fall into the pail and they need warmth and food and moisture for their growth. They find all these elements in milk and as soon as they fall in there from the dust on the cow's body they start to grow and multiply, some of them once in every few hours and unless the milk is cooled down immediately the work goes on energetically and very soon reached enormous proportions. So we must keep the dirt out of the milk in the first place and cool the milk right down to check this bacterial growth and keep the milk clear. Now, the dirt and bacteria come from the cow, the stable air or barn. There is dirt and dust sifts down from the hay over head and when the cows are not brushed off, we get contamination from them. Then sometimes we do not have the platform the length of the cow; the cow gets back to the gutter, and the gutters are not deep enough. The gutters ought to be built deep enough so that the cows will keep clean; we ought to use clean bedding; and the walls and floor ought to be as smooth and clean as possible. You may say that is folly and it will not hurt the milk. It is going to make the work of keeping things clean easier if the walls and floor are smooth. It does not cost very much

to build a barn where sanitary milk can be produced. It does not take a rich man to build such a barn. It costs the same as other barns. It has just to be plain and simple with no disease catchers and no dirt catchers. The manure wants to be taken away. One of the greatest wastes on the farm is right in the manure pile. It should be taken right out on to the fields at once. If the manure is piled up against the barn and there is water running through it, we are losing fertilizing value from it.

There are so many more things I would like to touch on, the milk house and cleanliness of milk. The worst faults I found with these, the acidity was all right, the chemical composition was all right, bacteria was pretty fair, but the flavor and odor are pretty badly off on the majority of the samples. There were some very good ones there, some better than I have scored any where else this fall on flavor and odor, but this is a very general defect; and then the bacteria, the scores did not run very high. The Pencoyd farm and S. A. Morse and Son make the highest score in bacteria in milk and S. A. Morse and Son for bacteria in cream.

A Member: Does that mean the fewest bacteria?

PROF. KELLY: The fewest bacteria. For flavor and odor the Willow Brook farm had the best flavored milk in the exhibit. The Pencoyd farm and S. A. Morse and Son with their cream were second. Freedom from possible dirt in the bottom of bottle J. L. Balderson had the best samples on the exhibition. No matter how carefully you think you strain the milk, just let it stand a couple hours and pick the bottle up and look at the bottom and see if you can see any sediment. Any specks in the bottom of the bottle will debar you from a perfect score under the head of dirt. Some of the bacteria count ran very good. Our perfect score for bacteria is only 400 a cubic centimeter. Certified milk agents usually require 10,000 or less, so that you see a score of 400 is mighty fine. The highest score we had was 374,000, and we had one of 5,000 and one of 16,000 another of 3,000 and one of 52,000, so you see we had at least five or six samples that more than beat the standard for certified milk. So that on the whole the bacteria counts were good. The certified score of ninety made by the Pencoyd farm is an exceptionally high score and denotes a superior product, and all those men who received ninety points or over are to be congratulated. They have accomplished a great deal, those who are in the ninety class, the honorable mention, and I do not want them to feel discouraged.

The value of a contest is two fold: It is primarily educational, and at the same time it has a commercial value. I have two letters received the other day after a competition, one showing the educational value in which the writer notes that he lost on odor and that it was due to the manner of feeding at the time of milking. This man learned a lesson from that condition. We talked to him afterwards just as we have done here tonight. The next competition he goes into he will know how and when to feed in order to make good on the flavor and odor. The other letter shows the value of these competitions from an advertising stand point. The writer says that the next morning after the announcement that he had won the people

came from every direction to congratulate him on his success. He says he had not expected to win among older and more experienced dairymen, but that he was very much gratified and had learned where he could make still more improvement. So we have two letters received, one showing the educational value and the other the commercial value of these contests.

ABSTRACT OF THE PROCEEDINGS OF THE STATE HORTICULTURAL ASSOCIATION OF PENNSYLVANIA, HELD AT HARRISBURG, PA., JANUARY 24, 25 AND 26, 1911

OFFICERS FOR 1911

PRESIDENT

Gabriel Hiester, ...Harrisburg.

VICE PRESIDENTS

Hon. W. T. Creasy .....Catawissa.
F. H. Fassett, ...Meshoppen.
R. M. Eldon, ...Aspers.

RECORDING SECRETARY

Chester J. Tyson, ...Flora Dale.

TREASURER

Edwin W. Thomas, ...King of Prussia.

PRESIDENT'S ADDRESS

By GABRIEL HIESTER, *Harrisburg, Pa.*

It is very pleasant to greet you again after a separation of a year, during which time we have all been working along practically the same line, thinking the same thoughts, fighting the same enemies, and, judging by the expression of the faces before me, reaping the same reward. Although we had some partial failures, owing to unfavorable weather conditions at critical periods, and some of us were badly scared for a few days during peach harvest, I think the year taken as a whole, has been a profitable one to the members of this association, and we have reason to congratulate ourselves on a bright prospect for the future.

The fruit exhibit in the other room tells the story of the possibilities of our soil and climate better than the words of any speaker, and those of us who have watched the exhibit from year to year can read a history of rapid advancement in the art and science of growing fruit. It shows advance in horticultural knowledge, improvement in business methods, and a general healthy growth in all directions. While it is right for us to feel a just pride in the progress we have made, it will not do for us to sit down and fold our hands, even for a day. If we were to take into account the great natural advantages of soil and climate in Pennsylvania for growing fruit, and the splendid markets that we have right at our doors, we must realize that we are not living up to our opportunities. Commercial orchards have been planted in a few localities, but there are yet many thousand acres of ideal fruit land on the foot hills of our mountain ranges, that will produce fruit as fine as any on exhibition here to-day that are absolutely neglected and not paying a dollar of profit to their owners. One of the objects of this association is to bring to the young men of the state a knowledge of the possibilities of these rough lands, and we will not rest contented until every acre of the fruit land on the foothills of these great mountain ranges shall be planted in fruit, representing one vast peach and apple orchard extending diagonally across the state from the Maryland line to the banks of the Delaware in Pike county, and the northern tier of counties shall be vieing with New York in the production of winter apples.

The questions is often asked: "Don't you think there is danger of over production?" to which I reply not so long as we grow perfect fruit and pack honestly, and make a proper selection of varieties. For ten years I have been urging the importance of having an investigation made to ascertain the effect of different types of soil and subsoil on the various varieties of fruit, so that as new districts are opened up we may be able to plant only such varieties as will develop their best quality in that particular place. And my reason for so persistently referring to this subject is that the most costly mistakes I have made have been mistakes in the selection of varieties. After many unsuccessful attempts to interest the authorities higher up, at last through the influence of Dr. Hunt, Director of our Experiment Station, the department at Washington consented to loan Mr. H. J. Wilder of the Bureau of Soils, to our station for one year. As most of you are aware he has been at work during the past summer and has secured much useful information from a number of widely different section of our state, but not enough to make a connected or strictly accurate report. He has made an excellent start, and I think you are all beginning to appreciate the importance of this work, and will agree with me that we should not be satisfied with one year's service. I hope at the proper time you will pass a resolution asking a renewal of the loan.

If we are going to grow apples extensively it seems to me they should be sold from Pennsylvania and go to the markets of the world as Pennsylvania fruit.

The western New York apple men are enthusiastic over a scheme to make Rochester the greatest apple market of the East. The plan contemplates the holding of a two weeks' apple show and sale in

Rochester to draw buyers from all parts of the country. The first apple show and market will be held the last week of November and first week of December, 1911.

I believe we ought to begin to lay plans for a similar show and sale in Harrisburg. You may think I am a little premature in this matter, but I find it is well to have a definite plan to work on—a plan that will provide for conditions that are bound to arise in the future. In less than five years we will be in a position to hold right here in Harrisburg as fine an apple show and market with as many barrels and boxes offered, as they can hold in Rochester next fall. I would suggest that our Executive Committee carefully note the progress of New York along this line, as well as the marketing methods of the far western states and the peach growers of the South, so that we may be prepared to formulate a plan suited to our own conditions when our young orchards come into profitable bearing.

The importance of working together is being more forcibly illustrated each year. We have found it of advantage in our township and county associations. We have found it of advantage in our State Association. On the 21st of December the Eastern Fruit Growers' Association was formed, which is designed to take in all the states and county associations of the Eastern coast states. Our association is invited to join. I will ask our Secretary to bring the matter up for action at the proper time.

In the matter of securing uniform legislation as to size of fruit packages and the grading of fruit we are invited to co-operate with New York, New Jersey, Michigan, Ohio and Virginia; this is a subject which concerns us all and I will ask the Secretary to make it an item of new business at one of our sessions.

We should keep in closer touch with the State Department of Agriculture and our State Experiment Station, they are all operated for our benefit and if we do not get as much from them as we think we are entitled to it is largely our own fault.

We find some very interesting results showing up in the orchard experiments of Professor Stewart; one especially attracted my attention. I referred to it in my report as Pomologist of the State Board of Agriculture, and consider it of sufficient importance to mention it here. Professor Stewart reports that nitrogen applied in the form of nitrate of soda to bearing apple trees in June after the fruit has formed, will increase the size of the fruit as well as the growth of the tree, but this increase in size is attended by loss of color in red apples; this loss of color Professor Stewart attributes to delayed ripening, and his opinion is that in those sections having a longer season—notably southern Pennsylvania—the fruit will regain most of its color. We all know if we spray our apple trees with a fungicide under proper weather conditions the foilage may be kept green and healthy until killed by frost, and when such is the case the fruit hangs on the tree much longer. This may mean a great deal to the orchardists in the York Imperial belt. If by the judicious use of nitrogen as a fertilizer and a proper fungicide as a summer spray we can hold our Baldwin, Spy, King and Smokehouse on the tree until the middle of October, by which time the sun will certainly have painted them the proper color, we can double

the profits on these varieties—and will be encouraged to plant more of them than we are now doing.

Since our Association was first formed conditions have changed very materially, so much so that we find our present Constitution does not meet the requirements of the times. During the interval between sessions, I have appointed a committee to take up this subject and in consultation with the Executive Committee suggest such changes as in their judgment are necessary. These amendments will be presented for your approval at this meeting. In conclusion I will quote a new year sentiment given by Governor Stewart because it is much better expressed than anything I can formulate: "Let us commence the New Year by resolving to do something worth while, something that will be of benefit to some one besides ourselves, and let us make sure that at the end of 1911 we shall be able to say that we have been of real service to our fellow men, our city, our state, our nation. Let us eliminate as much of the selfishness in us as possible, so that when the next New Year comes around it may be truthfully said of us, that we have remembered that there are others."

REPORT OF THE GENERAL FRUIT COMMITTEE

By J. D. HERR, Chairman, *Lancaster, Pa.*

In offering this report I wish to state that the data herein contained are compiled from one hundred local reports received from members of our committee located in nearly every county in the State, in reply to a list of questions sent out about December 1st. I desire to express my appreciation of the assistance given me by the members of the committee, and my thanks are hereby extended to all who have so kindly and carefully answered the numerous questions submitted.

The yield of apples for the year 1910 appears to average 40 per cent. of a full crop. This average is kept low because of the report of failure of the crop in the western half of the State, caused by a killing frost which visited that section about May 1st, after an unusually early spring had forced the trees into bloom. It is worthy of note that only orchards located on sites with faulty air drainage were affected, while others in the same locality, but situated more favorably, escaped uninjured.

The quality of the fruit is reported as good and very good by over 50 per cent. of my correspoddents. Twenty-five per cent. report poor, while the remainder is divided between medium, fair and "good where sprayed." Prices vary as may be expected, about as widely as quality, and range from 50 cents per bushel, and $1.25 to $3.00 and $4.00 per barrel. The prices in the commercial sections seem to have been $2.50 to $2.75 per barrel net at the time of picking, while such growers as have stored their crops are now receiving a considerable advance on these prices.

Eighty per cent. reply in the affirmative to the question, "Is the crop profitable in your county?" and only 6 per cent. in the negative, and these explain in the next answer that the failure to make the crop pay is due to lack of care, neglect, and indifference on the part of the owner. We have here an eloquent commentary on the possibilities of fruit growing in this State. Commercial planting is reported on the increase from sixty counties, the varieties most planted being Stayman Winesap, York Imperial, Jonathan, Rome Beauty, Grimes' Golden, Summer Rambo, and Smokehouse, in order named for the southeastern section of the State, while the Baldwin, Spy, Greening, Wealthy, Duchess, Stayman Winesap, McIntosh and York Impeedial appear to be the favorite varieties of the State.

In sharp contrast to the report of a year ago the yield of pears has been good, with exceptions, all over the State. The few counties reporting poor yields or failures are included in the section visited by late frosts, and such failure is attributed to this cause. The price and quality was good, except in some cases for Kieffers. Only 15 per cent. of replies report commercial pear growing on the increase, pear blight is without doubt the leading pest of this class of fruit trees, and may be a factor in preventing commercial planting. San José scale, codling moth, borers, and leaf blight, are other destructive pests mentioned.

The peach crop of 1910 was without doubt one of the heaviest ever grown in this State, many counties reporting 100 per cent. of a full yield. There was a combination of favorable conditions in nearly all sections where peach trees thrive in this State for the production of a full crop of fine fruit, the quality being reported good from all such sections, while the prices received were somewhat lower this season than the preceeding, ranging from 50 cents to $1.25 per basket, and averaging 80 cents. The crop is said to have been profitable in all sections of the State, except the northern tier of counties, in addition to Cameron, Elk and Forest.

The most destructive pests of the peach are said to be yellows, San José scale, borers, manilia rot, curculio; while under this head are mentioned winter-killing, vagabonds and neglect. No better evidence is needed to prove that the Pennsylvania peach grower knows the best methods of combating the pests common to this fruit than the uniformity with which these answers agree upon their treatment. Cutting out of trees infected with yellows, removing the borers, and spraying infested trees with lime-sulphur solution for scale insects, and as a protection against rot, is universally reported as giving the best results. The control of brown rot is, as yet, a problem only partially solved, since 60 per cent. report that this disease is not being controlled, a number having failed in their efforts to save their fruit, even by the use of the lime-sulphur washes. There is no doubt that most thorough going treatment must be applied to eradicate manilia rot from the orchard when it has once gotten a foothold, and pruning, gathering and destroying mummied fruits, as well as thinning, are giving best results in connection with the use of lime-sulphur sprays. All sections, except those already mentioned as not well adapted to the growing of peaches, report an increase in the planting of commercial peach orchards.

The yield of plums is given as fair to good over the State generally, with quality medium to very good, and the price averaged

$1.60 per basket. A few growers quote 20 cents to 30 cents per 8-pound basket, and this would seem to be a very good package in which to handle plums. The conditions governing the production of this crop were usually good, although a number of growers report late killing frosts as having curtailed the yield. Commercial planting of plums is not on the increase, except in half a dozen counties, and the varieties mostly grown are the German Prune, Lombard, Bradshaw, York State Prune, while a few prefer the Japanese varieties, as the Burbank, Abundance and Satsuma. The curculio is without doubt the most serious pest affecting plums. This, with brown rot, black knot, San José scale, together with limited markets in most sections for the fruit, no doubt has tended to deter extensive planting.

Sixty per cent. of my correspondents state that cherries are not grown largely in their respective sections, although where they are grown they are nearly always profitable. As to the best varieties for shipping, Montmorency receives the largest number of votes, with the Early Richmond a close second. Following in order are Dyehouse, Napoleon, Biggareau, Black Tartarian, May Duke and Reine Hortense.

There is but one section of the State in which grape growing is carried on extensively, viz: the extreme northwestern, and here the crop has been fair to good. In the remainder of the State grapes are usually grown for home use, and to supply the local markets to a certain extent. The worst pests of the grape are black rot, mildew, grapeberry moth, rose bugs, and root worms. Concord, Niagara, Worden, Brighton and Moore's Early are the principal varieties.

The favorite varieties of strawberries seem to be Haverland, Bubach, Dunlap, Sample, Glen Mary, Brandywine and William Belt. Of raspberries, the Gregg is the most popular, followed in order with Cumberland, Cuthbert and Kansas, as the best paying varieties of raspberries, and Snyder, Eldorado, Erie, Kittatinny, Meserreau, are voted the hardiest and best blackberries. The only other small fruits grown with profit reported are currants, gooseberries and dewberries.

The past season has, as a rule, been favorable to the growth of vegetables, and tomatoes, potatoes, beans, peas, cabbage, corn, asparagus and onions are crops which have paid best. The crop is generally profitable, and potato bugs, cabbage worms, root maggots, asparagus beetles and rust are the most destructive enemies. All but 6 per cent. of the replies contain the statement that the San José scale is now being held in check. The spray giving best results is lime-sulphur solution, this being given in all but five replies, which name scalecide in connection with lime-sulphur. Twelve state that the oil sprays are unsatisfactory, and eight that these materials are injurious to the trees, dentalizing them, closing the pores, cracking the bark, killing the bark and killing the tree.

Spraying for codling moth is becoming common throughout the State, and over three-fourths of the replies indicate that this pest is being successfully controlled by the use of arsenate of lead, Paris green and Pyrox. Only two failures to control codling moth with arsenical sprays are reported.

In spraying for the control of fungous diseases of the orchard, a remarkable change has taken place in the selection of the fungicide. Bordeaux mixture, for many years the standard, must now yield to lime-sulphur, the palm of popularity, since there are a slightly larger number of growers reporting good results from its use than from Bordeaux. The degree of dilution on apple and pear averages 1-30, while on peach it is reported as being used much weaker.

Collar rot is reported from fifteen sections of the State, and twig blight on apple, pear and quince from fifty. The only treatment reported successful is cutting out of diseased portions, spraying with a fungicide, and applying equal parts of lime and sulphur about the diseased collar of the tree.

Borers on apple, pear, peach and plum trees constitute a most serious menace to the industry of fruit growing, and 65 per cent. of the reports contain the statement that this pest is doing much damage in their respective sections. There is no perfect preventive of borers yet found, although a number of growers report fair success from the application on the trunk of whale oil soap solution, lime-sulphur solution, liquid manure, white lead and raw linseed oil, unleeched woodashes and wrappers. All recognize the necessity of cutting out borers when they have once entered the tree.

Mice and rabbits are doing considerable damage in many sections of the State, and it is evident that the proper steps are taken to prevent injury by these pests. Persons annoyed by them are cleaning up the rubbish in the orchards, killing the rabbits and applying to the trunk of the trees in orchard where damage is anticipated, veneer, wire screens, white lead and raw oil, blood and salty lard. I have personally found one orchard which was abundantly infested with these pests absolutely protected for five years from these pests by one application of axle grease to the lower twelve inches of the trunk.

The use of fertilizers in the orchard is on the increase, and one-half of the reports state that the practice is followed in their community. The best results attend the application of stable manure or a complete fertilizer to the amount of 400 pounds, mixed after the formula of 2—8—10. The use of lime is well understood, and it is no longer applied generally as supplying any of the elements of fertility, but an occasional treatment for the purpose of sweetening the soil and setting free the elements of fertility by its chemical action upon vegetable and mineral matter.

On the subject of tillage, most growers agree that young orchards should be cultivated either with or without an intercrop, a few answering that this is absolutely essential in the case of peach orchards. Many are practicing clean cultivation up to July, when cover crops are sown, and crimson clover is the favorite among these. Rye, mammoth clover, vetch, buckwheat and oats are other crops grown for this purpose.

Thirty per cent. of replies state that mulching is practiced in orchards of their section, especially in orchards planted on hillsides with good and very good results.

A slight majority of correspondents advise against the practice of heavy pruning of apple and peach. A number qualify their replies

by limiting this work to young trees only, and others take the medium ground that pruning should be done only when necessary.

There is a remarkable unanimity of opinion on the subject of thinning trees, all but two replying that this work can be done profitably.

The necessity of keeping bees in the orchard is still a mooted question, although the majority agree that bees play an important part in the pollenation of the blossoms.

In order to learn the general sentiment prevailing throughout the State, the question was asked: "What has been the effects of experimental and demonstration work as conducted by State College and the Department of Agriculture?" and the replies received are "Good," from twenty-five reports; "Awakened general interest in fruit growing," by ten; "Admirable," by five; "Very good," by six; "Very excellent," by five; "Many have profited," by three; and other answers are "wonderful and surprising," "Remarkable," "Aroused wonderful interest," "Made fruit growers sit up and take notice," etc., while one replied that "It has made a corpse walk and jump."

One correspondent objects to what has been and is being done in this direction, by saying that it is not the proper work of any State, or National Department, to do propaganda work in any particular industry. The reply to this objection is obvious, and that is that so long as the fruit trees of the State are threatened with extermination because of the failure to apply well known scientific treatment, or the State has thousands of acres of lands highly adapted to fruit growing, some Department of the State Government can well devote a small part of its revenue to disseminate this knowledge without laying itself open to the charge of paternalism. The fact that the Western states are shipping fine fruits into Pennsylvania, which have taken the place in all good markets of home grown fruits, should arose a feeling of pride in our own natural advantages and abilities, and this I believe is being done.

THE VALUE OF THE PROPAGATION OF FRUIT TREES FROM SPECIAL SELECTIONS WITH REFERENCE TO CONTITUTIONAL VIGOR AND PRODUCTIVENESS

By GEORGE T. POWELL, *New York City.*

It certainly gives me great pleasure to again stand before a Pennsylvania audience. It was my privilege between 1897 and 1904 to meet with many audiences in your State, called for the discussion of agriculture. I have attended some years every Farmers' Institute in your State, and have frequently spoken before your State Board of Agriculture. I remember on one occasion in speaking before the State Board of Agriculture on "Good Roads." When I finished, a member of the Board, who was a very intelligent old German farmer,

got up and said he was much interested in what the gentleman from New York said on "Good Roads," but, he said, "I don't think much of what he said about brakes on wagons, because I think he is a ——— poor horse that cannot keep out of the way of a wagon in going down hill."

This afternoon I am to speak to you on the subject of Orcharding and the Propagation of Trees. I do not know of a more important subject. We have been planting millions of fruit trees in the past few years, particularly of apple trees, and we are still planting apple and other fruit trees by the millions, and yet, never in the history of apple culture, have apples been so high as at the present time. We have seen a wonderful increase in the planting of fruit trees, and yet fruit is practically out of the reach of hundreds of thousands of our people who should have it. In 1896 the apple crop of the United States was something like 68,000,000 barrels, and we have never produced anything like it since. Our general yearly production runs from 23,000,000 to 45,000,000 barrels. Now, why is this so with all the extensive tree planting; why is there not an increased yield all over the United States? I believe one reason is that we have not given as much thought to the propagation of our trees as we should.

I can take you through orchards in New York state, and show you numbers of trees there that produce very little, and some years nothing at all. They simply cumber the ground, and thus the propagation of fruit trees becomes one of the most important subjects before our growers to-day.

Now, why should there such a different in the production of trees? Simply because there is in all plant life the same variation in productivity that we find in animal life. Every farmer here this afternoon, who may be a live stock breeder, will understand that. In his breeding of animals he discovers much variation. It is very seldom that you can breed from the same stock a number of colts that, when grown, will be of the same type. It is seldom that you can breed along the dairy line, two heifers from the same stock that will give an equal yield in milk and butter. It is this law of variation that makes it so difficult to produce in animals anything like uniformity, and in fruit trees this same law of variation is at work, hence we do not get uniform results in our orchards.

Now, my suggestion is this: I believe it is possible for us to get more uniform results in our orchard practice, if we study the stock from which we take our scions. In nursery practice, seedling stocks are used, and then we take the buds from the young trees in the nursery and put them on these seedling stocks. What is the result? We are grafting on our trees scions that have simply a vegetative tendency. It takes the Northern Spy, in New York state from fifteen to twenty years to come into bearing. I can show you trees that have borne no fruit in twenty years, and I firmly believe that by exercising the principle of selection, we can produce a high quality of fruit in a much shorter time. We need to take our scions from the more mature trees. There are choice varieties of Spitzenberg, Jonathan, Grimes' Golden—all very fine apples. Why don't we have more of them? Because they are not strong trees or vigorous bearers. The King of Tompkins County is another choice

variety, but it does not produce well. It is not of vigorous stock, is subject to canker, and the tree will pass out very readily. In fifteen years you will have a very broken orchard of this variety. Now, I believe it is possible to grow the King and the Spitzenberg profitably. I think I have proved this fact.

It is something more than twenty years ago that I began to advocate taking our scions from the strong, vigorous, more mature trees. I advocated it at a Nurserymen's Convention, but not a member of that Association accepted my theory. They said they did not believe there was anything in it; that a bud was a bud, and would produce a tree. Now, that does not apply in stock breeding. We know of instances where men have paid a hundred thousand dollars for a stallion. Why? Because he was recognized as a most valuable animal, and his prepotency was known. Now, this same principle will apply in plant life, and starting on this plan, I began to work it out. I choose as my first experiment, the King, because of its high value. I selected first the buds from an ideal tree, a King tree and top-worked Northern Spy trees; you know that tree is known and noted for its vigor. It has a good, strong root system, and when you can get roots that will go down deep into the soil and take strong hold, there you will have good and vigorous trees. It is twenty-one years ago since I started this experiment on my father's farm. He had planted the King trees, not one of which is now left in this orchard in which I experimented, we have trees that have been top-worked for twenty-one years; which show no evidence of canker, and are producing from seven to nine barrels of apples to the tree. Now, this is a wonderful record for the King; it is a fine fruit, but not a heavy yielder and yet these trees show every evidence of going right on and being profitable for a half or three-quarters of a century more. Now, that is what I mean by our propagating stock with greater care. I might mention one or two others—the Talman Sweet (the wood is like steel), the Northern Spy, the Northwestern Greening—are the same, so fine grained is the wood, and so hard; you can use these safely to work the other varieties on them. I believe in this way we can increase the yield of apples in the United States at least fifty per cent. in the next twenty-five years, and produce fruit more abundantly that consumers ought to able to have.

One other point. For a number of years, I produced among my trees large quantities of currants, but they were not satisfactory, and I began to investigate why the yield of this fruit should be so small, and I found that many of the largest appearing plants were not producing anything at all. I can show you by the chart here.

As the pickers came in one day, I discovered that a large number of trays came in with very little fruit from their rows, and then, again, other pickers came in with baskets filled in a very short time, heaped up with beautiful fruit, while it took the pickers in the thin rows a long time. I began to investigate, and found that in these thin rows bush after bush had no fruit upon them. They were large bushes, but had nothing whatever upon them. Many of the bushes were of this type—strong bushes, strong stem with perhaps only a single currant upon them, while side by side with them, were the bushes of this type—the bushes loaded from top to bottom.

These bushes were at once taken out and burned up, in order that we might not propagate from them longer, but propagate only from bushes like this. Thus we began propagating our bushes from strong producing plants. As the result of this selection, we have increased our yield from an average of only one quart from a type of bush like this to an average of sixteen quarts from a bush of this type. This is a principle of sixteen to one that beats William Jennings Bryan's financial theory of 16 to 1 in silver and gold.

By studying the productivity of the plant you can propagate from the most productive plants, and increase your yield from fifty to five hundred per cent.

Now, when we begin to study the tree from this standpoint there is not a grower who cannot, in a few years, build up an orchard that will be infinitely more profitable than it is to-day. Gentlemen, one of the most important things to do in setting out a young orchard, is to study the trees in your neighborhood, or somewhere else until you find those that have a given record of thirty, forty or fifty years, and take your stock from them and put it on the Northern Spy, or the Greening, or the Talman Sweet, and you can increase your orchard yield very perceptably.

Now, there is another very important matter, and that is the question of properly controlling the influences that interfere with the vitality of the tree. That is the question of diseases and insects. You can take the best bred tree, and reduce its ability to produce by repeated injury through the different types of insects. We have in our country gradually increasing number of insects, and they are producing a most deleterious effect upon our trees. Insects that are allowed year after year to denude the trees of their foliage, will in time so reduce their vitality and ruin their constitution, that we lose these important qualities in trees. My idea of spraying is that it is not only to destroy insects, but to increase the productivity of the tree; not only to maintain high quality of fruit, but to keep up the productivity of the tree. When you protect the tree from injury you preserve the source of future increase. Given a tree with strong vitality, strong constitutional vigor, and you can transmit to other trees, the properties that influence their production.

Another point raised on this subject was: At that convention the nurserymen said to me, we can't afford to grow trees on your plan; it costs too much. If we take the buds from mature trees they will fail to grow. That is true; buds from mature trees do not grow so well. "But," I said, "I would rather pay you a dollar for a tree grown after this fashion than take your trees grown from the nursery buds at fifteen cents apiece, because I can gain time by it." This point is disputed by some scientific men; they say it is a question whether you can get fruit quicker by bud selection. I have on my farm to-day some ten thousand trees many bearing fruit, and most of which were propagated along this line. I have produced Rhode Island Greening from trees that have been top-worked with selected scions and which have produced half a bushel of apples to the tree at three years. Now, you all know that the Rhode Island Greening is not an early bearer. It is usually seven or eight years, sometimes longer, before it begins to produce, yet in three

years from the time my trees have been top-worked, I can get from half a bushel to a bushel of apples to a tree.

During this season I have been able to make a record with the Wealthy apple. It is naturally an early bearer, and yet on my farm six years after the trees were planted and top-worked, we were able to show a profit of sixty dollars an acre. That is an unusual record. Let me say, in this connection, that in top-working it is of the utmost importance that the trees be kept in a growing condition especially where budding is done.

You cannot hope to meet with much success with what is known as the mulch system. You have to have thrifty, growing trees, otherwise the whole system will fail. You will understand that I am an advocate of culture in the orchard, not of the mulch system. Now, this wealthy orchard has been thoroughly cultivated from the time the trees were set out. During the year 1909 there was a very good setting of fruit, but the most of the fruit was taken off. Last year it came out with a magnificent bloom, and a fine setting of fruit. Then we went over the trees and had at least one-half of the fruit taken off. That was when the fruit was about one-quarter grown—about July 1st. Men and women were set to work again two weeks later, with instructions to take off anything between six or eight inches, on matter how perfect the fruit was. The results was that the fruit was very fine, and sold for $4.50 a bushel, so that after deducting all expenses for freight, barrels, commission, etc., when the balance was struck that young orchard showed the profit of which I have spoken.

Now, I believe that great value lies in propagating from perfect trees. You don't want one tree full, and the next half full, and on the next perhaps none at all. Through this method of propagation you may have every tree in your orchard giving you a satisfactory yield. There is no other way possible in which you can get unifority in orchards, and a greater uniformity in bearing, except through his principle of selection of which I have spoken and advocate.

I believe it is possible to extend this principle to the propagation of peach trees. Why is it, that when we have frosty periods in the spring, that a portion of the crop—perhaps one-half—in the same localities is not affected by the frost, and suffers no harm? How can you explain the fact that in the same orchards some trees will come out unharmed? Here comes in this same principle of variation, and it apples not only to the productivity of the trees, but also to hardiness and resistance in trees. I believe it is possible to so develop trees that they will not only show greater productivity, but will have greater resistance to frost, and will come out unscathed. Such trees are to be discovered and to propagate from them, in time will enable us to produce trees that will be practically frost-resisting. Also we should study and propagate trees for resistance to disease. I sent a men over Central New York to find a King tree that had been bearing for thirty years, and had in that time shown no signs of disease, and when he found it, had him send me buds from that tree from which to top work my Northern Spy trees. By working in this manner I believe it is possible to produce a tree that is also practically disease resistant as not a trace of disease has yet appeared in this King orchard.

APPLE RUST

By PROF. H. R. FULTON, *State College, Pa.*

The fact that certain of the rust fungi attack two entirely different host plants during their complete life cycle, is strange enough to challenge perhaps immediate belief. One of the most notorious examples of this is the stem-rust of small grains, which has a second stage on the leaves of the European barberry, a rather uncommon plant with us. In New England, where it early became established, growers of wheat noted what was also noted in the Old World, that grain rusted most when growing near barberry bushes; and so the practical patriots of Massachusetts, some years before the colonies became a nation, passed a law requiring the destruction of barberry as a protection for their grain crops against rust. Unfortunately, this rust has the ability to bridge over from one grain crop to the next without the aid of barberry, largely through infection of the fall-sown grains and certain wild grasses. Actual proof of the relation of the stem rust to grain crops on the one hand and to barberry on the other was first made by a German botanist in 1864.

Two years later a Danish botanist followed up the clue furnished by horticulturists' traditions, that apple and other pomaceous plants contract orange rust from cedars; and proved experimentally that certain European species of rust do pass from cedars to apple and related plants, and vice versa.

For certain American forms of cedar rusts, Drs. Farlow, Thaxter and others have established the relationships to pomaceous plants, and we now know with the certainty that comes from rigid experimental proof that at least four distinct species of rust fungi, all belonging to the genus *Gymnosporangium,* and all passing a part of their lives on junipers, attack apple in the other stage of their existence causing the sometimes troublesome orange or cedar rust.

The three forms commonly occurring on red cedar in Pennsylvania are readily distinguishable. The most common *(Gymnosporangium macropus)* forms on cedar twigs slowly during twenty months the peculiar smotish, brown swellings as large as a marble known commonly as "cedar apples." In spring and early summer these send out in moist weather, bright orange, elongated, gelantinous horns; and then perish. The second species *(G. globosum)* also forms "cedar apples," but the galls are rough and scaly, and the long gelatinous horns are replaced by short protrusions of rusty red masses. These galls persist for several seasons. The third species *(G. clavipes)* attacks larger twigs and causes very slight swelling, but the bark is roughened, and through cracks there protrude reddish masses of spores; it is also perennial, and may attack the low, straggling common juniper as well as red cedar. At maturity, always in the

spring months, the reddish or orange spores are produced for a single year in the case of G. macropus, for several years in the case of the other two. With moderately warm weather and continuous moisture for 12 to 48 hours, these spores will germinate in the gelatinous masses, and give rise to a limited amount of growth, and produce within this period a number of smaller secondary spores. As the mass dries, these last become detached, and being exceedingly small and light, are easily carried long distances by the wind, as well as by insects that feed on the masses. The gelatinous masses may swell and dry several times in April and May, as the showers come and go, giving rise to successive crops of secondary spores throughout a period of three or four, or perhaps six or eight weeks.

These secondary spores are short-lived, and to reproduce the fungus they must meet with suitable conditions of moisture, temperature and food supply within a very few days at most. The food supply must be leaves or the fruit, or possibly the young shoots, of some pomaceous plant; for *G. macropus,* it must be ordinarily apple, wild crab-apple or hawthorn; for *G. globosum,* apple, quince, mountain ash, or hawthorn; and for *G. clavipes,* apple, pear, quince, or juneberry.

The fungus threads, on entering apple tissues, develop slowly, and it is usually two weeks before the yellow spots are perceptible, and four to eight weeks or even more before they are completely developed. They are distinctly yellowish, early develop minute black dots on the upper side, later produce swelling of leaves toward the underside, and develop on the cushion thus formed a number of little cups with delicately fringed borders. Attack on fruit is near the flower end, spots growing to be as large as a silver quarter; there is no swelling but the fungus threads grow deeply into the flesh producing a conical, firm, slightly discolored mass. Superficially the black dots occur near the center and cups may be formed at the margin. This stage on pomaceous plants is known as the "cluster-cup" stage, which is closely similar but not identical for the several rust species. A third type of spore is produced abundantly in these cups, and serves to carry infection back to the cedars in midsummer or later, to produce in turn galls that may not mature until as late as the spring after the next, thus bringing us back to the starting point. Unlike the grain rusts, these parasites seem to have no means of spreading directly from cedar to cedar or from apple to apple.

During 1910, in southern Pennsylvania, Maryland, Virginia and West Virginia, there was an abnormally severe outbreak of the cedar rust on apple. The explanation for this is to be found, no doubt, in moist spring weather conditions that greatly favored apple infection. In Center county, Pa., at least, the cedar apples and pustules matured and formed secondary infection spores several weeks earlier than usual, and their production extended over about twice the usual period. Furthermore, moist weather prevailed several days at a time when young apple leaves and fruit were developing, a condition that promotes the formation of secondary spores, and their germination after chancing to reach the apple. The rusts on cedars we have always with us; what the effect on apples will be in any season depends, in so far as we know, largely upon weather conditions.

I have tried to enlarge my limited observations for the past season by seeking information from apple growers in the four states named. The majority of these reports show that red cedars have grown very near badly infected orchards and there is abundant and striking circumstantial evidence of their relation to outbreaks. Sometimes the cedar trees are reported at a distance of ½ to 1 mile. This is no bar to their being a source of infection. Estimates indicate that a "cedar-apple" is capable of producing upwards of 30,000,000 infection spores; this would furnish 50 for every square foot of a 20-foot fence encircling the tree at a distance of one mile from it; and ordinarily an infected cedar tree produces quite a number of cedar apples. Of course the chances are against most of the infection spores being carried as far as a mile; but certainly many are carried farther by strong winds. The vast majority will chance not to lodge upon a proper host, and of those that do, many will perish in the absence of favorable conditions for germination. But there are enough infection spores formed to insure a certain number finally meeting with conditions suitable for growth.

More anomalous are cases of apples near cedars rusting less than those farther away. Three conditions might bring this about. The varieties growing nearer the cedars might be non-susceptible ones; winds prevailing at the proper time for transferring spores might carry them away from the nearer trees, and towards trees further away in another direction; and thirdly, the cedar trees that were in mind may not be infected with any of the three dangerous species of rust, while some unnoticed cedar nearer the infected apples might be the real source of the rust. For the rust species, although common, do not necessarily infest every cedar tree. In our class work in freshman botany, we have occasion to use a good many cedar apples annually, and we go to three or four lots of cedar trees where they may be had in greatest abundance; all of these have susceptible pomaceous plants growing near.

Two or three correspondents do not know of any cedar trees in their localities, and yet have the rust. If there is no confusion of other apple troubles with the rust, the question arises whether after all a close search might not reveal a few cedar trees that have passed unnoticed.

While some striking cases have been reported of prevailing spring winds carrying infection from cedars to apple, it must be remembered that an occasional blow from an unusual quarter, if at just the right time, may be more potent than days of wind when conditions are not suitable for infection. The question of how far spores may be carried in quantity, is the question of how far any dust-like particles may be carried, and depends upon the force of the wind, its upward or downward path, and the encountering of obstacles. A mile or two seems not at all impossible.

Removal of cedar trees near apple orchards has frequently given highly satisfactory results. The efficiency of this measure will be greatest when the cedars removed are the sole or main source of infection for this particular orchard. Wherever valuable though susceptible varieties of apples grow, cedar trees should be removed from the vicinity as completely as is practicable. Wild pomaceous plants, susceptible like the apple, may grow among the cedars and

help to keep up a hotbed of infection ready to extend to neighboring orchards when conditions favor. Such pomaceous plants should be destroyed also. From reports and observations, I have tried to tabulate a number of varieties according to rust susceptibility. In its preparation error may have come from necessary dependence on unaided memory; from the fact that different assortments of varieties will show differences in the relative rating of any given variety; from varying local chances of infection; from the biennial fruiting of some varieties; from the possibility that different ones of the three species of cedar rust have been involved in different localities; and possibly from differences in individual resistance within the variety.

For fruit infection, the most susceptible varieties to be York Imperial, Fallawater, Rome Beauty, Smokehouse and Ben Davis. Less susceptible are Rambo, Simth's Cider, Red Doctor, York Stripe, Summer Queen, Bellflower and Winter Banana; while very slightly affected varieties are Jonathan, Stayman Winesap, Baldwin and Northern Spy.

Susceptibility of leaves to infection does not follow the same order. York Imperial seems to be undoubtedly most susceptible. Followed at a distance by Ben Davis, Wealthy, Newtown Pippin, Jonathan, Maiden Blush, Gano, Stayman Winesap and Grimes' Golden in descending order of susceptibility. As to resistance sufficient to make the variety practically, if not absolutely immune, opinion must be somewhat more guarded. Grimes' Golden is general choice for first place in resistance. In a second class come, curiously enough, York Imperial and Ben Davis, along with Black Twig. A less number mention York Stripe, Baldwin, Stayman, Winesap, Northern Spy, Dominie, Porter and Strinetown Pippin.

The effect on yield is variously reported,—from nothing or very little, up to 80 per cent. in one case, and 90 per cent. in another; these figures being for some special tree or group of trees. When leaves are badly infected during a season, the manufacture by them of food for storage and bud formation is interferred with, and a shortage in the next season's crop from such trees is to be looked for. In some instances leaf attack has been severe enough to prevent proper maturing of the current crop, notably when rust attack was severe enough to cause early defoliation and consequent dwarfing of fruit on the trees. The quality of fruit directly attacked is greatly lowered. Many sold such apples for cider this last season; but with strong market prevailing others disposed of theirs as No. 2's, or along with the general run of the orchards. Buyers seem not to have been as critical as they may be another season.

From the habits of the fungus, proper spraying ought to control cedar rust on apple. In practice, in closely watched experimental tests, the results from spraying have varied from success to failure. In the light of last year's experiences it seems that routine spraying for scab with Bordeaux, self-boiled lime-sulphur, commericial lime-sulphur and certain proprietary preparations is not a sure and reliable preventative of rust.

Cedar rust shows considerable seasonal variation in the time of infection spore production; and these spores are formed in several crops extending over a period of a month or two. If fungicidal

spray applications are timed according to the frequent swelling of the moistened spore masses, the treatment will prove costly, and cannot be carried out during periods of continuous moisture.

It is also difficult to apply promptly enough to be effective when the danger is greatest. Where such procedure has been most carefully tried, using Bordeaux mixture, the rust was diminished on the sprayed trees, but not satisfactorily controlled.

We ought to know whether apple leaves and fruit are susceptible equally at all stages of development, or whether the period of susceptibility is somewhat restricted. The constant occurrence of rust spots at the flower end of the fruit is suggestive; although this may simply mean that spores lodge here more securely and have more moisture for germination.

It may be that the disappointing results from spraying are due to the use of fungicides that are less effective against this fungus than against others; for we know some fungi may be controlled by preparations that are ineffective for others. Several correspondents have noted some reduction in rust from the routine use of Bordeaux mixture or Pyrox; but I have received only one report of pronounced success. I wrote again asking for further information on several points, but in the absence of a reply, I simply quote from the first letter: "York Imperial yield is cut 90 per cent. the first 100 feet (from the red cedars); and about 75 per cent. the second 100 feet; and about 50 per cent. for the next 500 feet. We sprayed with lime-sulphur solution, Bordeaux, self-boiled, lime-sulphur, and atomic sulphur. All the other sprays failed except atomic sulphur, which finished up a crop of very fancy York Imperial Apples worth ten dollars per tree within 100 feet of red cedars on my neighbor's land, where the unsprayed trees were not worth picking. Our observation is that no fungicide applied after May 15th will do any good toward controlling cedar rust." I simply pass on to you this bit of experience as it was reported to me, and leave you to judge its merits.

Serious outbreaks of cedar rust are sporadic and so have been the attempts to devise reliable methods of control. In the east and south and middle west there is the constant possibility of an epidemic, and hardly a season passes without the report of serious loss from some apple growing district. We need to have at our command a knowledge of means of control that can be relied upon in such emergencies.

APPLE BLIGHTS

By PROF. H. R. FULTON.

It has been suggested that this Association might be interested in a discussion of apple blights; and by the plural form of the word I understand to be meant mainly the various forms of the bacterial

blight, caused by *Bacillus amylovorus,* affecting the fruit spurs or new twig growth or the bark of larger limbs and trunk or possibly the crown region of the tree, and perhaps also two or three troubles, caused by higher fungi, which may resemble bacterial blight superficially in their effects.

The story of bacterial blight is an old one with you, and I have little that is new to bring either from my own work or the work of others, We must keep constantly in mind the fundamental facts about this disease of apple and pear and quince. It is constantly present in most orchards. It is highly contagious. It is transferred largely by insects, and gains entrance through wounds, however slight, and exposed flower parts. It spreads rapidly and becomes destructive when warm, moist weather conditions favor; this may be at the time of flowering, with destruction of flowers, and later of forming fruit, or it may be late in the season with little immediate damage. It spreads downward in twigs, fruitspurs and water sprouts, finally becoming established within the thick bark of large limbs; it may girdle these killing important parts of the tree; and it winters regularly in such cankers, thus starting new infection the following season.

Blight can be kept out of orchards, but it requires systematic, persistent, thorough-going effort. Affected twigs and spurs must be looked for regularly and frequently at dangerous periods, and removed before the infection spreads to larger limbs, the removal of which would entail greater loss. Trees should be kept clear of useless water sprouts and on very susceptible varieties, fruit spurs had best be confined to smaller limbs. In cutting away affected twigs, limbs, and bark canker areas, care must be taken to include all possibly invaded material. In active lesions the bacteria push constantly forward into new regions, and always exist beyond the evidently dead portion. It is a good practice to cut twigs and limbs a foot below apparently affected parts if possible, remembering that if any part of the invaded tissue is left, the work has been for naught. The greatest difficulty is in dealing with cankers on larger limbs, and it is well worth while preventing their development by promptly removing affected twigs and spurs before infection extends to the parent limb. Sometimes these occur in crotches when it is hard to get at them; and always there is little chance to cut away much bark beyond the dead area. But all bark showing any discoloration inside must be cut away if the work is to be successful. In all of this removal work, disinfection of wounds and tools must be carried out. Wound disinfection is placed first because of wounds are clean cut their prompt disinfection will not only destroy bacteria immediately introduced from possibly infected tools, but will offer continued protection for some time to come. If a sponge or swab is carried, it is easy to touch every cut surface with the disinfectant, and to wipe the tools at frequent intervals. A number of antiseptic substances might be used; probably the best is corrosive sublimate in strength of 1 to 1000, or one ounce to seven or eight gallons of water. Of course, the larger wounds should afterwards be painted with thick lead and linseed oil paint. While it is a safe precaution to collect and burn all infected trash, it is far

more important to get it removed from the trees than from the ground. The bacteria die quickly in pruned twigs, some tests made last summer indicating that four or five days is about as long as they can be expected to live in these under ordinary conditions, while on the trees they might continue active development for weeks or months.

In this general connection comes the matter of collar-rot, crown-rot or root-rot of apple trees. The exact nature and all the factors concerned in the development of such troubles, are not understood. It is likely that two or three distinct troubles affect the region of the tree in question. It may be that the blight organism iself plays a part at times, at least in extending the rot. The matter is under investigation, but the problem is a complex one, and work must be carried on for several seasons before definite conclusions can be reached. Meanwhile, I should like to know from you and others as much as possible about the occurrence of such trouble in the orchards of the State. For control, I would suggest the importance of guarding against the spread of possibly contagious material from tree to tree especially in worming. The use of 1 to 1000 corrosive sublimate solution on all wounds and tools is a reasonable precaution in such work. If the affected bark can be reached and cut away thoroughly at an early stage, so that there is a border of good live bark around the wound; and if the wound is disinfected with corrosive sublimate or lime-sulphur and painted with thick lead and oil paint or tar, so as to promote healing, the lives of some of the affected trees may possibly be saved. I realize the difficulty in most cases of reaching the underground parts satisfactorily and of applying these measures in advanced stages of the disease; but I do not believe it is worth while making an effort to check the spread and to prevent early girdling of the tree. In some cases bridge grafting may be resorted to advantageously.

Another thing to do is to give each affected tree every chance to make vigorous, thrifty growth, and as we say, to outgrow the trouble. The sooner the diseased condition is recognized, and these methods adopted, the better the chances for success. If the soil seems thin or packed, resort to judicious fertilization or cultivation. Guard against drouth conditions by adding humus or by mulching or by practicing shallow cultivation. Try to give the sick tree proper food and moisture and soil conditions. Check the natural tendency to over-bearing that comes from partial interference with the normal transportation of food from tops to roots; the tree will need as much building material as possible for the replacement of the diminished root system. Therefore, prune judiciously to retard top growth and to reduce a large leaf area that would make excessive demand for water upon the roots. Thin the fruit freely or remove it entirely. It is well worth losing a crop or two from an infected tree if the life of the tree can be saved thereby.

I would like to discuss the other bark and wood diseases found in our apple orchards, but time does not permit. In general, for all of them, the means of control are the prompt recognition of the disease and thorough destruction of affected parts, which serve as

sources of further infection; and the disinfection of wounds, and along with these some missionary work to induce our neighbors to follow our example; and effort on the part of all to put out of existence the worthless wayside trees that so often carry over such pests from season to season.

THE RELATION OF THE SOIL TO PLANT LIFE AND THE VALUE OF TILLAGE FOR ORCHARD DEVELOPMENT

By GEORGE T. POWELL

On the subject for discussion this evening, "The Relation of the Soil to Plant Life," practically depends the continuance of our entire work. As a nation, we have enjoyed for a period of perhaps two hundred years, the greatest prosperity. We have been the best fed nation in the world during this time, and have accumulated great wealth. In fact, we have, as a nation, accumulated in the last three centuries, greater wealth than has England during two thousand years. How has this been accomplished? Simply because we have been given a soil richer than any other in the world, and we have been taking the wealth out of it and using it to build up our great nation. In the past three of four years, there has come over our nation a surprise in the unexepected and sudden rise in the cost of living. It has affected our entire population, especially that portion of it living in our large cities. The country has been drained of its population, and millions are congregated in cities, and we are now confronted with this problem of the cost of living, which has ranged upward from 30 per cent. to 300 per cent. Now we are confronted with the problem of giving back to the soil the fertility which we have been taking out of it for more than two hundred years. We have been taking out and putting nothing back to replace the plant food that is necessary to retain the fertility of the soil. We are now to meet the problem of the depletion of our soil, while our yields per acre must be increased. In the past two centuries we have increased our yield of wheat per acre but two or three bushels; England has far exceeded us in that respect. In England, the average yield per acre is thirty-four bushels, while in this country it is but fourteen and a half. We have been increasing population but nowhere have we correspondingly increased in production. As I said to-day, we find millions of people unable to eat apples, because of the exorbitant prices demanded for them.

Another point I wish to speak of, is the reckless destruction of our forest lands. We have swept across our great continent, and cut away our great forests until we have subjected our soil to the dryness that comes to a soil denuded of its trees. Not only is our soil becoming depleted, but there are places where our water supply is becoming exhausted. The last year has been remarkable for the depletion of our water supply. Many of our large cities, especially

in the East, have been suffering as never before, for want of water. Towns and cities in New York were weeks without water supply in their houses and on their farms. We are now paying the penalty for the wholesale destruction, for soil depletion, and our forests, and it is necessary for us now to do something to restore this plant life and to renew the fertility of the land.

I desire to discuss this evening the relation of the soil to plant life, and what we may do to bring it up again. In the first place, we know the extent to which every tree, and every plant, and every flower that grows is dependent on the soil, for its life, hence the necessity of understanding that each year the ability to sustain plant life is lessening, and that unless something is done to replace this lost fertility, each year is lessening the supply, and increasing the cost of living to humanity.

I may say that the soil is nowhere near exhausted of its plant food even to-day. I don't believe that there is any danger of exhausting the soil anywhere in this country. We have millions of acres of depleted soil, but not one acre of exhausted soil in this country. The Great Creator was wise in his provisions for maintaining all life and he so placed them that it is practically impossible to exhaust them. We have reached the stage where the soil is beginning to disown the people who have abused it, and that is why we see the cities crowded to-day. Many people who thought they owned their farms find that the injured soil has disowned them and driven them away because of the neglect that was shown it.

Now we want to consider how most economically fertility may be restored. There are methods which may be employed to build up needed plant food. Some of them are very simple. Away back in the sixteenth century there lived a man by the name of Jethro Tull. He was a great student of the soil, and he discovered that tillage was a very important factor. He though he discovered that plants actually took up particles of soil as food. He was a student, and left a book in which he tells of the increased yield from tillage. He is the first writer on the subject of tillage. We know now that he was mistaken in his theory that plants take up particles of the soil, yet no man has done more for the improvement of the soil than did Jethro Tull, because he first discovered that by tillage we can increase production. Why? Because there is hidden away in the soil enough plant food still to meet the demands for centuries to come.

Next to tillage comes another question of green crops. I want to apply this directly to the orchard this evening. In setting out an orchard, it is necessary to understand the soil, its character, type and quality. There are many orchards set out to-day on the wrong type of soil. I said this afternoon that there are millions of trees planted that are not producing fruit. One reason is that there are many trees planted on soil that is not suited to the production of the apple. That is one of the reasons so many trees planted add nothing to the increased production of fruit.

There on this chart are shown two distinct types of soil. On the right side you will see entirely distinct types of soils. It is of the oldest limestone formation; here you get the clay soil and the clay loams. On this side of the chart are the sandy types. This sandy

type will almost always be found along the coast. Along the Atlantic coast, particularly, you will find it, and it is generally well adapted for market gardening; therefore, along the coast line from Maine to Florida we find the market gardens more than elsewhere.

As we go back from the coast we find the more mountainous country; here we have more of the limestone soil, and here is where we get our finest fruit. The old limestone is not in every part of our country. We find it in California, in Washington, in Oregon, then in Colorado, in Michigan, then on Lake Champlain, in New York, and along the Hudson River Valley, where you get this soil, you can grow trees and fruit as you can nowhere else. So it is important that when a man is first starting to invest money in the fruit business he should know something about the soil, so that he may make no mistake in his location.

Here on the chart is a form of soil known as "Hardpan." I remember a number of years ago in going over your state, I came across a small stretch of country where nothing seemed to flourish as it should; the farms did not show a prosperous appearance, the trees and the woods looked stunted, the houses and barns were small, and the people themselves were poor and not prosperous. I found that the soil was made up of this type of hardpan. This hard sub-soil that comes up to say, within six inches of the top soil is very unfortunate for farming. You will find sections in the East and in the West, with this kind of soil. Impervious to water, it works like a cement floor, and is a very poor fruit soil. It is always either too wet or too dry, and can not be well tilled.

Then here is the very sandy soil, which is almost as bad for fruit. It is almost always dry; the moisture and the manure applied seeps through it in a short time ,and leaves it dry and crops suffer for moisture.

Then, knowing our soil, we must begin the practice of right tillage and give to plants the conditions they need. Our finest soils are clay, or clay loams, but by tillage we can increase the productivity of all soils. The one principle of tillage is to make available the plant food that is in the soil. That is why clover is so difficult to grow to-day, is because certain forms of plant life have been depleted and acid conditions have developed that are injurious to the growth of clover, which grew so luxuriantly in your state not so many years ago. In the last sixteen years, since I have been experimenting with clover, I have increased the productivity of my soil one hundred per cent. and I have spent but little for commercial fertilizers, although I am a believer in them. By tillage you can realize the plant food that is still abundant in the soil, and yet it to work to sustain and to make large crops.

In my orchard practice, on the farm that was owned by my great grandfather, who raised hay and corn and wheat; the same policy being followed by my grandfather and father when I began to farm, I found the orchards were not bearing as they should. I discovered that the plant food had become much depleted. If you will allow me a little of personal history—My father was a good farmer and a good business man, and he helped others in bank backing until one of these senseless panics came along and swept away his friends and accumulations. When I inherited the farm of one

hundred acres, I also inherited with it obligations of $10,000. Most of you will think this was a pretty heavy burden for a young man just married. The first thing I did was to set about studying the soil and how to improve it, and I have never failed to pay one hundred cents on the dollar, and the farm today is better than it ever was, and covers at present nearly three hundred acres.

I believe that it is possible for most any one to take soil, and to begin without a dollar, and make it provide support. In order to do this, I believe it is only necessary to study the philosophy of tillage, and follow intelligent practice. What does the clover plant do for us? Every time we use the clover plant—especially if we use the Mammoth clover—it sends its roots down into the soil and loosens up the sub-soil and brings up the plant food that has never yet been touched. It brings up the phosphoric acid, and potash and adds to the soil nitrogen. The clever plant, like other legumes, such as cow peas and beans, have the power to take from the air itself nitrogen, and help to build up the soil by adding to it the nitrogen that we know it needs. It is like a miracle, this building up of the soil by the legume plants. I have improved my soil principally by the use of clover, and it is a pleasure to go over my farm year after year and see the improvement that is taking place by means of the plant food that I am putting back into it. I remember a number of years ago when I first came to this state and advocated in your institute work the sowing of crimson clover, the following year I was asked to go over portions of your state and make a special study of your buildings, your cattle, and your farms, in order to be able to discuss the subject even more effectively, and in going over the Pennsylvania Railroad through some beautiful sections of your state, here and there I saw fields dotted with crimson clover in sections where I had advocated it in the institutes. I knew there were the elements of fertility being added to the soil, and I never traveled anywhere with greater satisfaction than I did at that time when I saw the Crimson clover that had been sown in the corn fields. I am firmly convinced that you can grow crimson clover in your state and thereby restore to the soil much of its lost fertility. You have a wonderful power in your hands, and can use it to build up your soil, and add to it the nitrogen it wants, largely taken from the atmosphere.

Another important point in tillage is this: We must have moisture in the soil as well as plant food. I have recently made an examination of a large stretch of country in New Mexico that was opened to irrigation. I spent several weeks in studying the effect of water upon the arid lands of that state, and when coming back to my own farm, I found in the midst of a very dry season, just as beautiful apples, just as red and as fine as in that irrigated country of New Mexico, where they have to sink wells down 200 or more feet to obtain a supply of water. I found a beautiful crop of apples on my farm, because I had by tillage saved the moisture of the year before. I don't believe that we will ever have to spend a dollar for irrigation in the East. All we have to do is to save the water by tillage. As the season advances, the temperature rises, and becomes higher and higher on the surface; then there comes the pressure of the moisture in the soil, pressing upward to be evaporated.

Now, how much moisture do you suppose one acre will take out of the soil in twenty-four hours? Every dry day in June, with the North wind blowing, every single acre of meadow grass will take up one hundred tons of water. What will a single large tree take up? It will require about six and one-half tons of water every twenty-four hours. Then we must make a point of conserving this moisture, and that is done by the stirring and re-stirring of the soil until we hold back the water supply that is so abundant in this subsoil.

I made an experiment in peach culture a few years ago. In starting in at the beginning, I had followed the methods of the peach growers of Michigan. I began in this orchard the system of daily tillage, and continued it until those peaches were ripened and marketed. That season we did not have a rain fall of an inch from the time the peaches were one-quarer grown until they were marketed. Every day that orchard was harrowed, one day in one direction, and the other in the next. While we were marketing the early ones, the harrowing was still going on for the latter ones, and while the market was filled with peaches selling at fifty cents a basket, I did not sell a carrier for less than $2.50. You may say that was expensive; so it was, but look at the returns from an acre of peaches at that price. It proved that we can successfully provide against drought by proper tillage and with irrigation.

PENNSYLVANIA HORTICULTURE*

By PROF. R. L. WATTS, *State College, Pa.*

The following is a brief outline of the lecture delivered on this subject with views which were secured by the speaker as he had opportunity.

Pennsylvania horticulture may be best shown by contrasting with operations along horticultural lines in other states. Our State occupies a prominent place in practically all of the varied lines of commercial horticulture. Immense green houses have been built in recent years and the growing of vegetables as well as flowers is conducted on a much larger scale than a few years ago. The fruit industry has received a wonderful impetus during the past three or four years. Large areas are being planted to apples, peaches, plums and other fruits and there is every reason to believe that the developments of the near future will be even greater. The pictures which you will see to-night will show that we are not behind other regions which are well known for their aggressiveness.

Starting in Ohio, we first want to give you some idea of the extensive work done in the greenhouses and gardens of M. L. Ruetenik. On this farm we find about two and three-fourths acres

*Illustrated by lantern slides.

of glass devoted to the growing of lettuce, tomatoes and cucumbers. The houses are large and provided with the Skinner system of irrigation so that the cost of operation has been reduced to a minimum. This overhead system of watering has also been installed for most of the work out of doors. It has revolutionized the work on this farm of eighteen acres where intensive methods have been used for many years. Manure is employed most freely. It is customary to apply horse manure from the livery stables at the rate of fifty tons per acres annually, both in the open and under glass. With such liberal application the returns have been large and satisfactory.

One of the best crops on the Ruetenik place is celery. The crop is grown on a large scale for marketing from late July until Christmas. All of the plants are started under glass, spraying at short intervals to control blight. For the early crop, plants are set in the open ground after danger of hard frosts. As soon as possible after planting, fresh manure from the livery stables is applied as a mulch between the rows at the rate indicated. It is customary to allow the manure to remain in small piles for a few days before applying. When used at the rate of fifty tons per acre the mulch is about five inches deep mid-way between the rows, sloping gradually to the plants. This mulch conserves moisture in the most effective way and also furnishes a liberal supply of plant food when the water is applied by means of the above ground system. This plan of culture has been signally successful both with the early and late crop and it has been rapidly extended in the Cleveland district as well as in other parts of the United States.

Long Island has long been known as one of the most intensive market gardening sections of the United States. One eight-acre garden near Brooklyn gives steady employment during the summer to thirteen men. The most largely grown crops in this garden are beets, lettuce, radishes, carrots and other crops which may be planted close together. Ordinarily the rows of crops which are worked with wheel hoes are not more than ten inches apart. On most farms, however, twelve inches are allowed between rows. In the intensive gardens it is quite customary to start a second crop before the first crop has been removed. Manure is used with the greatest freedom and thorough tillage is given throughout the season. At the east end of Long Island is located Mr. L. H. Halleck, who is one of the most extensive market gardeners on the island. He cultivates 80 acres of land and gives employment to 40 or more men. The men are cared for in neat colony houses, coming together for their meals in a central boarding house which is managed by Mr. Halleck. There are few establishments in the country which the handled as skillfully as that of Mr. Halleck. Fertilizers and manures are used extensively on the Halleck farm. All supplies are brought to the farm by steam boats operated by Mr. Halleck and all vegetables are taken to market by means of the same boats. A full line of market gardening crops are grown at this place.

There are many operations about Boston to interest horticulturists. The work in New England is intensive and there are many skillful growers. Manure is used with freedom and many growers also resort to the use of commercial fertilizers. A general line of

garden crops are grown for the Boston market. The greenhouse industry is especially large near Boston. Lettuce, tomatoes and cucumbers are the most important crops. Probably no city in the United States grows more cucumbers than Boston. Nearly all of the greenhouses are 40 feet wide, of the three-fourths span of construction and many of them several hundred feet long. Cucumbers are also grown extensively as an early summer crop in cold frames as shown in the accompanying picture.

One of the most important trucking centers of the East is Sweedesboro, N. J. Immense quantites of early tomatoes and sweet potatoes are shipped from this station. At Glassboro, N. J., are located the extensive orchards of Mr. Albert T. Repp. Four hundred and fifty acres are devoted to apples, pears, peaches and grapes. The apple is the leading fruit in these orchards. Winesap has been most largely planted. The trees are pruned very lightly until they come into bearing. All of the spraying is done with gasoline engines. Ever since the appearance of San José scale in the Repp orchards, crude oil has been used with entire success in combatting it. Practically no trees have been lost from the effect of the scale or from injury of the oil. The secret of success of applying oil on Mr. Repp's trees is to put it on as finely as possible. It is applied in a very fine mist so that no large amount is permitted to collect in any one place. The spray is so exceedingly fine that two gallons of oil is sufficient to spray a tree that is twenty-five years old. Mr. Repp has his own storage house which is large enough to hold 10,000 barrels of fruit. The apples are placed in five-eighths bushel hampers in the field and covered with paper and placed at once in storage. As a rule the apples are in cold storage an hour or less after picking. They are graded and repacked when shipped. Ordinarily the apples are held in storage until May or June.

The Patapsco Neck, near Baltimore, has long been known as one of the most important gardening regions in the United States. The fertility is maintained by manure which is taken to the farm on barges, and the use of commercial fertilizer. Cabbage and spinach are perhaps the two most important crops grown near Baltimore, although a large variety of vegetables are produced for Baltimore and northern cities.

The most important trucking district of the United States is at Norfolk. A visit to this district is necessary to gain a proper conception of the magnitude in which trucking is conducted in this region. Tomatoes, spinach, beans, peas, cucumbers and many other crops are grown by thousands of acres and by as intensive methods as is possible in truck farming. Fertilizers have been used with the greatest freedom in this community. It is not uncommon for a grower to apply one and one-half tons per acre each season. Some of the growers are free to admit that fertilizers have been used too freely, or rather than green crops have not been grown as largely as possible to keep the soil in the proper condition. The growers in this region have begun to use lime because they find it is necessary to reduce soil acidity. The use of lime has been the means of sweetening the soil and rendering it more useful to possibly all the crops grown in that region. The Norfolk Truck Experiment Station, of which Professor T. C. Johnson is director, has been exceedingly val-

uable in helping to solve the problems of the hundreds of producers in this locality. A number of frame growers operating near Norfolk have been realizing good profits. These men start and mature practically all their crops as beets, spinach, lettuce and cucumbers in frames. Overhead irrigation has been a great advantge on one of the places which has met with great success.

Leaving the South and coming back to Pennsylvania it is a pleasure to show a number of pictures of the splendid orchards in Adams county. This region is not only well known to the horticulturists of this state but it is known in many parts of the United States as a region which has been remarkably successful in the production of apples. Most of the pictures illustrate the spreading or open-head method of pruning or training. As is well known, York Imperial is the leading variety. Probably nine-tenths of the bearing trees in this county are of this variety. In most recent plantations, Stayman Winesap has been planted to a considerable extent and is doing well. Grimes' Golden, Jonathan, Rome Beauty and a few summer varieties have been planted to some extent in the young orchards.

Kennett Square has long been known as one of the most prominent mushroom sections in the United States. Most of the mushrooms are grown in inexpensive houses, although a few more costly establishments have been built and have met with success. Mr. H. K. Hicks has, for example, erected a mammoth building with a double cellar in which he has been meeting with entire success. The greenhouse industry is also a paying proposition. Not only are roses, carnations and other flowers grown, but tomatoes are grown extensively for the Philadelphia market.

The last census report shows that Philadelphia county is fourth in the United States so far as yields and returns per acre are concerned. Some of the best and most intensive market gardening as well as truck farming may be found both north and south of the city. The farm of Thomas Brooks, Jr., is especially notable as being conducted in a thoroughly up-to-date manner. Practically no weeds can be found on this farm at any season of the year. The crops follow each other in quick succession and companion cropping is largely practiced on this farm. Stable manures are relied upon mainly for the support of plant food. They are composted before using and then applied in large amounts. A great variety of crops, such as rhubarb, carrots, onions, celery, tomatoes, cabbage, lettuce, etc., are grown north of the city. South of the city the places are restricted mainly to crops that may be planted close together, permitting the use of intensive methods.

One of the best examples of intensive gardening may be found in Lancaster city. Ritchie Brothers have been cultivating vacant lots and meeting with entire success. Rotten manures are used more freely, perhaps, than in any other garden of the State and sprinkling devices are also employed to control soil moisture conditions. Intercropping and succession cropping are used to a great extent.

One of the notable establishments near Harrisburg is that of Mr. Robert J. Walton, of Hummelstown. Fruit growing and market gardening on a considerable scale are carried on here and a thoroughly equipped and very satisfactory Skinner system is in operation.

Most of our horticulturists are familiar with the grape industry of Erie county. Hundreds of vineyards near Northeast have been returning to the owners satisfactory profits. Probably 95 per cent. of the plantings in this region are of Concord.

Many of the market gardeners and truck farmers which we have met during the past few years grow a large percentage of their own seed. This tendency is on the increase, not because dealers are selling poorer seed than formerly but because growers realize more fully the importance of growing and using the best seed. Some of the most successful growers in the United States have become plant breeders in a practical way, their seeds being produced by dealers who recognize the importance of furnishing their patrons with the very best seed. I regret that it has been impossible to show more views illustrating horticultural operations in different parts of Pennsylvania.

I am certain there are many people here to-night who are interested in the work of the Department of Horticulture at the Pennsylvania State College. Experiments are being conducted along various lines. In vegetable gardening, cabbage, tomatoes and asparagus are receiving the most attention. The aim of the Department is to make a most thorough study of the most important questions relating to the culture of these three crops. All of these vegetables are of the greatest commercial importance to Pennsylvania. The strain tests with cabbage and tomatoes have been particularly valuable. The results indicate great variation in strains of the leading varieties of cabbage and tomatoes. In Early Jersey Wakefield for example, some strains have cut about $100 more per acre than others. There have been marked differences in types and yields. An acre of experimental asparagus is giving most excellent results. Measurements and weighing show that it is exceedingly important for commercial growers to plant large crowns of plants rather than small ones. Palmetto seems to be the best variety to plant because of its power to resist disease and its vigor and productiveness.

The entire field of horticulture is covered by the various courses of study which are offered by the college. Most of the subjects are taught by lecture with accompanying laboratory exercises. Responsibility is placed upon the students as much as possible so that they will develop self reliance and attain the greatest possible efficiency in the management of crops under glass as well as in the open. In greenhouse work, for example, each student is assigned given areas on which he grows lettuce, tomatoes, cucumbers or perhaps flowers. He is held absolutely responsible for the plot, giving the care that may be required from day to day. On the college farm he is also assigned areas for garden work for which the student makes plans and then carries out his plans. In plant propagation the students are taught budding and grafting in a practical way. The root-grafts, for example are tied together in bunches with the student's name attached and he afterwards plants them in the nursery on the college farm. There are three distinct values to be gained in conducting laboratory work in this manner. First, it creates enthusiasm. Second, it develops self reliance. Third, it gives the student an opportunity to become familiar with the practical operations in market gardening, vegetable-forcing, floriculture and orchard management.

VEGETABLE-FORCING UNDER GLASS

By C. W. Wald, *Carlisle, Ohio.*

Indeed, it gives me great pleasure to meet with you for the first time. Most of you are strangers to me, but I feel at home in spite of that fact, for two reasons, at least. In the first place, my father was born in this State, and in the second place, in meeting with the horticulturists in different parts of the country, we find that the problems they are trying to solve are the same, and it is easy to make friends if you are looking for them.

I find with you, as with us, that the subject of apples is most prominent, and probably to most of you, of the most interest. You have with you one of our most expert growers in Ohio, Mr. Farnsworth. He is a man whom we in Ohio, consider an authority because of the able way in which he produces a first-class fruit. You can bank on what he says being backed up by experience and success. I, myself, have eighty acres of orchard started, but not in bearing as yet. But there are other products in the Horticultural line besides the growing of apples, and since coming here, I have learned that you are producing along the lines about which I am to speak to you, but I doubt whether most of you realize this opportunity as you should.

You talk about the Western man coming into the Eastern market and selling his apples. Do you know what the greenhouse men are doing to-day? Men in Massachusetts and in Ohio and in New Jersey are buying your coal and your glass and sending the lettuce back to your people and selling it, and making money on it, too, and good money at that. Is there no opportunity here for you? There are a good many in the business, but not nearly so many as could profitably engage in it, and I hope if you are not already interested, you will consider the subject with me this morning and become interested. I am confident that many of the young men under Professor Watts will take up this work and make a success of it, and vegetable forcing under glass will be one of the lines.

When I accepted the invitation of your Secretary to talk to you on this occasion, I told him that I make no pretense to being a public speaker. Unlike most of those who have preceded me, I am seldom able to get away for even this length of time, as our work is very confining. I realize that looking after the details of the business is where success usually comes. I will now take up my subject, and if there are any questions that I can answer, I shall be pleased to do so.

No doubt most of you are aware that vegetable-forcing in Ohio has attained very large proportions during recent years. The places at which the greatest development has occurred are Ashtabula, Toledo and Cleveland. All located in the northern part of the state and not far removed from the lake. Besides the development at the

places named, small or medium-sized plants have been built near or within easy shipping distances of most of the larger cities throughout the state. It would seem safe to say that at least one-half of the present area of glass in Ohio has been built within the last ten years.

At Ashtabula there are less than a dozen plants all located within a mile of each other. These sets of houses cover over twenty acres of ground. At Toledo there are about one-half dozen large plants and a large number of small greenhouses. The total area covered by glass and devoted to vegetables is probably somewhat greater than that at Ashtabula. The largest plant in the state is that owned and operated by the Searles Brothers, at Toledo, and consists of a set of old houses covering three acres and a new plant which was planned to cover ten acres, two acres of which is yet to be built. This eight-acre greenhouse plant is all under one roof. The service room alone would be considered a good-sized greenhouse by many growers.

At Cleveland there are a very large number of houses, many of which covers one-fourth acre or more. Mr. M. L. Ruetenik's plant which covers about three acres is the largest. The total area would probably not be over one-half that at Toledo. There are only a few small greenhouses in or near Cincinnati. This is probably due to the fact that growers there have depended on hot beds and cold frames and have not as yet become much interested in the construction of greenhouses.

STYLE OF HOUSES

The style of houses in use varies considerably although the narrow span is most popular. Most of the large plants at Toledo and Ashtabula are made up of sets of narrow span houses, the width being about 15 feet and the length varying from 100 to 750 feet. The Crane Bros., of Toledo have both narrow and wide houses. The wide houses are 45 to 50 feet in width and about 350 feet in length. They are individual houses, having been built separately and are giving satisfaction. This style of houses has a decided advantage over the connected houses in a section where the snowfall is heavy. It takes a comparatively short time for the snow to slide off of a roof which has no gutters of connected houses. Our own houses are 32 by 200 feet and connected. We find that the snow clears from the outside slopes much quicker than from the inside.

So far as results are concerned we find good crops growing in narrow and wide houses, connected and disconnected houses, in houses running north and south and east and west. It would seem from this that the style of house has little to do with the quality of the crop grown. This is assuming that all of the construction is good. Light, clean houses are always superior to dark, dirty houses. The style of house which we select will depend on our own individual preference, the comparative cost and apparent durability. We usually find more or less similarity in construction in each community. This shows the tendency to "Go and do—likewise."

It is the opinion of the writer, although I must admit that I have no data to support my statement, that wide houses can be heated more economically than narrow houses. It would also seem

that when tender crops such as cucumbers and tomatoes are grown in midwinter that the danger from draughts would be much less in wide than in narrow houses.

HEATING

At Ashtabula and Cleveland nearly all of the houses are heated by steam. At Toledo hot water is the popular method of heating. Anyone who thinks hot water not practicable for large plants should visit Searles Brothers' eight acre plant. The water is pumped through the system. The heating pipes as I remember are all 1¼ inch pipes. They are run in sets near the surface of the ground, one set under each gutter. The houses are 750 feet long and the heating pipes half that length. In our own houses in which there are 20,000 sq. feet of glass we heat with hot water. The boiler is a Kroeschell with a mercury generator attached. The heating pipes are two-inch, one flow and two return in each set. For houses the size of ours or smaller there is no doubt but that hot water is the most economical method of heating. It would take a careful set of experiments conducted over a long period of time to determine whether steam or hot water is most economical for large plants.

GLAZING

The most popular size of glass is the 16 by 24 double strength A. glass. B. glass is used in a few instances and a very few growers use single strength. In most cases the 16 by 24 glass is laid the 16 inch way. The glass on our own houses is laid the 24 inch way. This gives a very light house and has been quite satisfactory. Once last winter when we had an unusually heavy snow and drifts formed to a depth of from 3 to 4 feet in the gutters, several glasses were cracked. It would seem from this experience that it would not be wise to space the glass the wide way in a section of the country where heavy snows are common. If the glass is spaced the 24 inch way it is advisable to have some glass, either in the sides of the house or in the roof of a small house spaced the narrow way. This should be done so that use can be made of the panes of glass from which small corners are broken.

There is quite a difference of opinion as to whether butted or lapped glass is to be preferred. As a general thing there is less drip from lapped than from butted glass. On the other hand butted glass is more secure than tapped as the cap holds it is place. Butted glass is usually easier to keep in repair than lapped.

SOIL AND SOIL TREATMENT

The soil at Ashtabula is very sandy while that at Cleveland and Toledo is a sandy loam. It might seem from this that sand is necessary in the vegetable forcing business. This is not the case, however, as it has been demonstrated by the Experiment Station and several growers throughout the state that heavy soils will give results equal to sandy soils. In any case large amounts of organic matter should be added to the soil. I would as soon have clay loam as sand for the basis of the soil for forcing. The soil in our green-

houses was made up of two parts clay loam, which contained a fair amount of organic matter and available plant food, one part muck and one part stable manure. It will be necessary, no doubt, to add more muck from time to time in order to keep the soil mellow and in a good physical condition.

It is only in rare instances that soils are renewed in vegetable forcing houses. Several years ago I saw a crop of lettuce growing in soil which had been in continuous use for thirty years and the crop I saw was a very good one. So far as I know this soil is still in the houses. In most cases the greenhouse soil is kept in a productive state by the addition of large quantities of well rotted stable manure which is spaded into the soil just previous to the planting of each crop. The Ohio Experiment Station and a few growers in the state have for several years followed another plan of renewing the soil fertility. Briefly the plan is as follows: As soon as the tomato or cucumber vines are removed from the houses, about August fifteenth, a heavy coat of manure is spread upon the soil. Water is applied at frequent intervals, once or twice a week, and in sufficient quantity to leach the fertility out of the manure into the soil. Just before the first crop is planted the coarser part of the manure is removed and the finer worked into the soil. No more manure is added to the soil until the tomato or cucumber crop is to occupy the ground when well rotted manure is worked into the soil or coarser manure applied as a mulch. Thus two or three crops of lettuce are grown with but one application of manure. This is the plan we follow and we have found it very satisfactory.

As a general thing little or no commercial fertilizer is used in vegetable forcing houses. Tests which were conducted by the Ohio Station demonstrated that commercial fertilizers can be used to supply the plant food in greenhouse soils but it is necessary to supplement them with some form of organic matter. Manure or muck being suitable for this purpose. When stable manure which has not been exposed to the weather can be secured in sufficient quantity without too great an outlay there is little use made of commercial fertilizers for greenhouse work. There is need, however, of further investigation by our Experiment Stations and others to determine when and in what quantities commercial fertilizers can be used to advantage in vegetable forcing houses.

Lime has been used with good results in some cases. We save all of the ashes which result from the burning of the tobacco stems and work them into the soil.

Soil sterilization has been found necessary in many of the commercial houses. Steam has given best results although formalin has been used successfully in some cases. The outfit for sterilizing with steam should consist of a steam boiler with connections to perforated pipes buried in the soil to be treated. The soil is not moved from the beds or benches but treated where it is in use. The steam is forced into the pipes under pressure and the pipes are not removed or moved until the soil is literally cooked. Where subirrigation is used the steam is turned into the tile for sterilizing the soil. Some of the Ashtabula growers use muck in which to start the seedling plants. The muck is placed in a box through which perforated pipes are run, the steam turned on and the soil sterilized

before it is used. This treatment kills all diseased germs and weed seeds and thus renders it ideal for a plant bed. On heavy soils it is necessary to allow the soil to stand untouched at least one week and two weeks is better after sterilizing, before any planting is done.

To sterilize with formalin use 1½ to 2 quarts of formaldehyde to fifty gallons of water applying one gallon of the solution to each square foot of surface. This solution may be applied through the overhead watering system if such a system is in use. Formalin has given fairly good results as a means of overcoming the disease known as Lettuce Rozette but is not effective in controlling lettuce rot.

CROPS GROWN

The general practice in Ohio is to grow three crops of lettuce followed by one of cucumbers or tomatoes. This is varied somewhat by different growers and different years. Tomatoes are grown as a fall crop in a few cases. A very few growers force cucumbers in the fall. Radishes, beans, cauliflower, beets, parsley, etc. are all grown more or less. In a few instances chrysanthemums are forced instead of lettuce in the fall.

LETTUCE

Grand Rapids lettuce is grown almost exclusively in Ohio. One of the difficulties which confronts the grower right at the start is that pure seed is hard to get at any price. I have yet to see a crop grown from seed purchased from a seedhouse that did not show some tendency to revert to the coarse dark colored type. The Ohio Station has secured seed by selection which is very nearly pure. This shows that it is possible to produce pure seeds and the growers should let the seedsmen know that they want pure seed and are willing to pay for it. It is not necessary, however, to depend on the seedsmen for lettuce seed as it can be grown quite easily and the greenhouse who secures satisfactorry strain by purchase or by selection should grow his own seed.

At Ashtabula the seeds are sown in solid beds which have been covered to a depth of four to six inches with sterilized muck. The seeds are covered with moist brown paper. As soon as the plants are large enough to handle they are pricked out in other muck filled beds being spaced about two inches apart each way. The root development of the plants in this soil is remarkable. The plants are allowed to grow to a height of three or four inches when they are removed and transplanted in the permanent beds.

The Toledo growers use flats in which to sow the seed and grow the young plants. These flats are about one and one-half by two feet in size and the bottoms are made of closely woven galvanized wire. One of the chief advantages of the flat method over the ground bed is that the flats may be carried to where the planting is done and the plants removed and set with much more dirt in contact with the roots than is usually the case where the plants are removed from the beds, carried some distance and handled a second time before they are set. There is however, a large amount of work connected with the handling of the flats which offsets much of the gain. Another advantage of the flats is that the roots are more

or less confined, the soil being shallow in the flats, and thus overgrown plants are less frequent with flat grown than with bench grown plants. If it were possible to set the plants every time just as soon as they were large enough this advantage would be slight but it is frequently necessary to hold them several days after they are of sufficient size and the flat grown plants can be held with less danger of injury than those grown in beds. The Toledo growers do not let their plants grow as large as the Ashtabula growers before setting in the permanent beds.

In our own houses we start the lettuce in flats and make one transplanting into flats. The first crop is not transplanted but once until it is transplanted from the flats to the beds. For the second and third crops the seed is sown in flats, the seedlings pricked out in flats and as soon as crowding begins the plants are transplanted into two-inch pots or into flats and given more room. When the pots are used they are plunged into the soil between the rows of lettuce, twice as many pots as there are plants in a row. In this way we are able to secure very stocky plants which when planted by the side of those which have not been transplanted the second time show a gain of two or three weeks over the smaller plants. This gain in time we think justifies the extra work involved. By setting the pots between the plants in the beds we have two crops growing on the same ground at one time and thus economize room. When the plants are plunged in the sub-irrigated beds we give the soil a thorough watering as soon as the pots are in place and little or no further watering is needed as a sufficient amount of moisture is drawn into the pots from below. The same is true of the beds watered with the Skinner system. I would not recommend this practice, however, where the watering is done with a hose in the old fashioned way.

When the plants are set in the permanent beds they are spaced 7 by 7 inches which we think a very satisfactory distance. The soil between the plants is stirred once or twice with hand weeders. This is done to kill weeds and to prevent the formation of a crust on the surface of the soil. If the green aphis is troublesome we scatter tobacco dust over the surface of the soil just before the leaves spread enough to cover the ground. Much care is taken in distributing it not to get the dust on the lettuce leaves as it is very hard to wash off after it has been on the leaves for some time. It is also a good plan to work some of the dust into the surface of the soil before planting.

Most growers aim to keep a night temperature of 45 degrees with a day temperature at least 10 degrees higher. We aim to run the temperature somewhat higher than this at night, 48 to 50 being what I consider about right. On cloudy days we do not try to run the temperature above 60 and 55 degrees is satisfactory. When the sun shines the temperature often runs very much above this but no harm will result if the ventilators are opened wide. Ventilating the houses is one of the most important operations connected with greenhouse work and I might add that it is the one most commonly neglected. Our houses are provided with ventilators on both sides of the ridge and on the sides and we make use of all of them. It is only on very cold, zero or below, weather or snowy days that

we keep the ventilators closed in the day time. When the nights are warm we leave them up an inch or so all night. If I were to give the cheapest and surest way to prevent lettuce rot in the greenhouse I would say use elbow grease on the ventilators.

PACKING AND MARKETING LETTUCE

The Ashtabula growers pack all of their lettuce in splint baskets, four pounds to a basket. The Cleveland growers sell in the local market and pack in bushel crates. The Toledo growers pack in large sized barrels. We are able to procure barrels at a low cost and as our market is close we can pack in barrels and place on the market in good condition. We ship by traction and sell through commission men. If we were to sell to grocerymen direct we would pack in a five or ten pound box or basket.

The important thing in packing is to put in nothing but clean marketable lettuce and have it alike throughout the package. Do not leave long stems, dead or rotten leaves on the plants.

The Ashtabula growers are most of them organized into an Association, called "The Ashtabula Lettuce Growers' Association," Mr. E. A. Dunbar is General Sales Manager and looks after the selling of the combined produce of the members of the Association. This does away with the competition and resulting cutting of prices among the growers themselves which I have been informed was quite common before the organization was formed. It also enables the growers to give more time to the growing of their crops as they do not need to devote any time to the selling of them.

Growers who are located near a good market have a decided advantage over those who ship long distances. They are able to place the lettuce on the market in a fresher condition and thus can get one or two cents more per pound for it. They are not compelled to pay as much expressage and are often able to cut out one or more middlemen.

CUCUMBERS

At least 75 per cent. of the total area of glass for vegetable forcing in Ohio is devoted to cucumbers in the spring and early summer. The White Spine is grown more than any other kind. Seeds are planted in pots or in solid beds about four weeks before the plants are to be set in the permanent beds. The time of setting varies with different growers and different seasons and extends from March first to the middle of April. Cucumbers are more particular than lettuce as to treatment and must be handled with much more care. The temperature should not be allowed to go below 65 and 70 is better. Daily ventilation should be given but cold draughts should be avoided. When started in pots care should be taken not to overwater, on the other hand the plants should not suffer for lack of water. Cucumbers should be given all of the room in the beds as the plants grow so fast that other crops do not have time to mature before the cucumbers occupy the space. Seedling plants grown in flats may be placed between the cucumber hills for a short time but should not be left too long.

The soil for cucumbers should be supplied with an abundance of available plant food either by applying manure to the soil or by mulching after the cucumbers are set. The spacing of the plants varies more for cucumbers than for any other greenhouse crop. When the inverted V shaped trellis is used upon which to train the vines the rows are set from eight to sixteen feet apart, and in a few cases even wider, and the plants from 6 to 18 inches apart in the rows. When the vines are trained upright the plants are set from two to three feet apart each way. When the vines are trained on an inclined or V shaped trellis the cucumbers hang below and are easy to gather. The chief objection to this form of training is the unequal distribution of the roots in the soil. Our practice is to set the plants two feet apart each way one plant in a place, and train the vines straight up. This gives a very even distribution of foliage and roots as well. While I have only meager data at hand, some tests made at the Ohio Station a few years ago indicated that the largest yield per square foot is secured when the cucumers are planted two by two feet rather than much wider apart one way and closer the other.

Nearly all growers practice removing all laterals or side runners. Some cut them off next to the main vine while others clip them just beyond the first female blossom. The last method gives the most fruits in my judgment. Bees are nearly always kept in the houses during blooming time to assist in the pollinating of the flowers.

As soon as the cucumbers are large enough, picking begins. After the first week or two we pick three times a week. The cucumbers are graded into first, seconds and culls. The second grade runs smaller than the first but the specimens must be of good color and not too irregular. No effort is made to sell the culls.

The Ashtabula, Cleveland and Toledo growers use the same package for cucumbers that they do for lettuce. We have found the 24-quart berry crates a very satisfactory package to ship in. They must be nailed securely and the slats removed from the tops. Some of the Toledo growers turn the hose on the cucumbers after they are in the barrels. We have always avoided wetting them using a cloth or gloves to clean when sandy or in need of cleaning.

Cucumbers have the advantage over tomatoes of coming into bearing earlier or sooner after they are set in the beds. There is usually less work connected with the growing of cucumbers than tomatoes but the tomato crop is surer. The comparative net profits depends on the prices at which both crops sell.

TOMATOES

As I am scheduled to treat the subject of tomatoes this P. M. I will only refer to this important greenhouse crop in a general way at this time. The tomato is a very satisfactory crop to force in greenhouses for spring and early summer markets. The quality of greenhouse tomatoes is so superior to anything on the market early in the season that when the trade has once learned to know the difference the demand is nearly always good. The crop is dependable, also, thus serious loss is seldom experienced.

RADISHES

It is only occasionally that radishes are forced as they are generally considered less profitable than lettuce. We grew radishes the last two seasons and while the returns were not as good as from lettuce at good prices yet they were better than from lettuce at low prices. One crop gave a net return of 8½ cents per square foot which is about the same as 8 cents per pound for lettuce. Our method of growing them was different from that usually followed. Instead of thinning the plants so that each radish would have plenty of room to develop we left the plant quite thick in the rows, from one-half to three-fourths of an inch apart. As soon as a few of the radishes were large enough for market they were pulled and this answered the purpose of thinning. In a few days another pulling was made and so on until all had developed and were pulled. This gave us a much larger yield per square foot than we could have secured any other way although the time required to grow the crop was somewhat longer than it would have been if the plants had been thinned out more at the start. The varieties used were Fireball and Scarlet Globe. We also grew some Icycle but they will not stand crowding as well as the button varieties.

An oversupply of lettuce is not an uncommon thing in the early fall. In order to avoid this it is well to devote some of the space to other crops at that time of the year. Radishes, string beans, cauliflower and beets are all suited to this purpose.

The writer does not know how well the markets are supplied with greenhouse products in your state, but if there are any cities of 10,000 or more population which are not supplied locally with these crops each one is offering some one an opportunity to make a good living. No one should start in the greenhouse business, however, on a large scale without having had some previous experience along that line. Vegetable forcing under glass is most exacting and requires the closest attention to details of any form of gardening. On the other hand there are few lines of work which will show the effects of a master hand more quickly and fully or give more genuine satisfaction to the man who likes that kind of work than vegetable forcing under glass.

THE MUSKMELON

By PROF. J. W. GREGG, *State College, Pa.*

It affords me peculiar pleasure to be present at a meeting of this Association and have the privilege of addressing you upon a subject dealing with a crop that to many minds is the garden's unequaled delicacy.

Writers tells us that the muskmelon has been grown as an article of food from a very early date, and that from the hotter parts of the Orient it has been introduced all over the world until to-day it

is a favorite in many home gardens as well as of great commercial importance in many sections of this country. At the mere mention of the name we immediately think of New Jersey, the Delaware Peninsula, Maryland, Ohio and the districts around Rocky Ford, Colo. We think of these sections as affording ideal soil and climatic conditions, of their methods as the best and of their growers as thoroughly up-to-date as the light of modern science will permit. However true this may be, the fact remains that we are usually very much disappointed in the fruit from these sections as it reaches our markets and tables, and we are rapidly recognizing the high-quality of home-grown melons whenever they are to be found on our markets.

We find that comparatively few melons are raised in Pennsylvania and that our larger markets are being supplied almost wholly by the sections previously mentioned, while merchants in many of our smaller towns and villages do not pretend to handle them at all, thereby depriving a large rural population of a most delicious and healthful food. This condition should not be so, because by continuous breeding together with the varying soil and climatic conditions of this country the melon has become adapted to a wide range of territory and is capable of being grown in larger numbers in Pennsylvania. I presume, however, that the low status of melon growing here in this state may be due to three causes, first, lack of knowledge regarding culture. Second, the tendency to late maturity, and third, improper selection of varieties. Many have failed or obtained only partial success because the requirements of the crop have not been thoroughly understood. Soil, seed, planting, cultivating, harvesting, marketing, insect pests and diseases are all factors that spell success or failure in proportion to the amount of knowledge and proper practice of each.

It is not my purpose this morning to lay down any specific rules that will guarantee a crop of melons, but rather to consider somewhat broadly perhaps the vital points of melon growing in Pennsylvania with the hope that some suggestions may be offered that will lead to a more general production of this highly desirable article of food.

While we usually recognize a sandy loam as best adapted to melon growing, it is a fact that heavier soils containing a considerable amount of clay, if well drained, well located and supplied with humus and plant food will grow good melons. I would select if possible a piece of land that has a good slope to the South in preference to land on the lower levels, because the former is more quickly warmed up in the Spring, natural drainage of the soil is usually better and there is good air drainage. Such land should be brought into as high a state of fertility for melons as for any other crop. Soil capable of growing a good clover sod may be considered in good condition for melons in fact, it is recommended to plow down a clover sod in the fall and in the spring make an application of yard manure at the rate of 10 or 15 tons per acre. The fall plowing should be deep and the working of the soil with a disc or cutaway in the spring should be most thorough in order to completely incorporate the manure with the soil and to make the soil open, loose and fine and capable of holding large amounts of moisture for the

future needs of the plants. The melon is usually considered a shallow rooted plant and for this reason soils in the past have not been worked very deep, but it has been my experience that a deeper root system is encouraged by a deeper working of the soil and this means stronger and healthier plants and a better crop in every respect. The melon plant when well grown has an extensive root system, as well as a large vine and leaf surface, and it takes a large amount of plant food to support this growth. We do not need to worry about getting the soil too rich for melons providing the plant food is well balanced. I mean by this that if clover sod is plowed down and heavy applications of manure have been made we will need to use phosphoric acid and potash in sufficient amounts to balance up the nitrogen that has been added to the soil by the clover and manure, otherwise the plants are liable to produce too much vine growth at a sacrifice of fruit. I believe many plants blight or become weak and stunted in growth late in the season because of the lack of sufficient plant food to hold the plant up during the period of fruit production. Chemical fertilizers have not been used successfully in the Colorado districts but I believe here with our heavier soils they may be used to advantage and the sources of supply for the different elements should be chosen with reference to a gradual availability in order that the plant may be kept growing throughout the season.

It is impossible to recommend a fertilizer that will suit all conditions. Each man will have to work out his own fertilizer problem and apply in amounts to suit the needs of the crop in his soil. A fertilizer that has been found satisfactory in many cases consists of four per cent. nitrogen, eight per cent. phosphoric acid and ten per cent. potash applied at the rate of 800 to 1,500 pounds per acre. It has always been my practice to apply the phosphoric acid and potash and a little of the nitrogen broadcast and thoroughly work it into the soil with a harrow and save most of the nitrate of soda to be used as a top dressing to start the plants off after they have produced their first true leaves or after they have become established if transplanted from a cold frame. Some growers on a small scale especially prepare each hill using two or three forkfuls of manure in the bottom and covering with about four inches of soil in which the seed is sown, but the general practice is now to prepare all the soil evenly and thoroughly.

After the soil has been put in good condition the seed may be safely sown about the 15th of May and by the time the young plants are through the ground all danger of frost will be past and the nights will be getting warmer. I do not believe anything is gained by planting seed too early in cold, wet soil. The seed germinates slowly and the plants are often stunted by cold nights and show the effect throughout the season. There are two methods of planting with varying distances for each. Seed is often sown in hills, the common distances being six by six to facilitate cultivation in both directions. The larger growers, however, are now planting in hillrows ranging from seven to nine feet apart and sowing enough seed so the plants may be thinned to stand two or three feet apart in the row. This system requires more hand cultivation but has the advantage of allowing two rows of early peas to be grown between

each row of melons before the melons need the space. Care should be taken not to plant the seeds too deep. An inch and a half is deep enough in light soils, while an inch is better with our heavier soils.

By sowing seeds in hotbeds and transplanting to the field it is possible to gain one or two weeks in the ripening season. Great care and attention is necessary, however, to grow the plants strong and healthy in the frames and in transplanting them to the open ground. The melon is a plant that does not like to have its root system disturbed and as a result, careless planting often checks the plant to such an extent that it is a fit subject for disease or insects and if it succeeds in living at all it shows the effect of the check throughout the season.

After the plants are up, or immediately after transplanting, they should receive constant cultivation to check all weeds and to conserve moisture. Shallow cultivation should be kept up until the growth of the vines prevent. Hand weeding and hoeing must often be resorted to to keep weeds from occupying the space needed by the melon vines.

After sowing the seed or transplanting the young seedlings from the hotbed to the open ground we must be prepared to fight insects and disease. The striped cucumber beetle is probably the worst enemy of the plant during its first stages of growth. Various remedies have been used and recommended but probably the most valuable of all is Bordeaux mixture as its presence on plants is distasteful to the beetles especially if some poison like Paris green or arsenate of lead is added. Bordeaux mixture at 4-4-50 strength with one-half pound of Paris green or two pounds of arsenate of lead will effectively control the beetle.

The one objection to this mixture, however, seems to be that it should not be used until the plants begin to vine as it has a tendency to check the growth of young plants. Tobacco dust with powdered arsenate of lead added forms a very reliable repellant up to the time the Bordeaux can be used. It is a question with me just how many beetles die from the effect of the poison, probably a few but to my mind this mixture does more to keep them away than to kill and they are expert at dodging sprayed or dusted plants. For this reason, trap plants may be left untreated for them to feed on until this period of danger is past. Clean culture in the fall also serves to destroy winter hiding places for the beetles.

The melon aphis is the other serious pest that must be fought. It is advisable to watch the young plants closely and pull up and burn if only a few plants are attacked. These insects are somewhat difficult to combat as they work on the under side of the leaves and must be killed by a contact spray. A ten per cent. solution of kerosene emulsion sprayed on the under side of the leaves with good force will successfully control the aphis, but the great difficulty seems to be in hitting all of them and they must be hit to be killed.

Rust is the worst fungous disease of the melon and a great deal of attention is being paid to the breeding of a rust resistant variety. At the present time a variety known as Pollock seems to be showing up quite well along this line. All experiments, however, tend to show that this disease can be successfully controlled by spraying with Bordeaux mixture (4-4-5) or (4-5-50). The first

spraying may be made as the plants begin to vine and other applications made as growth takes place in order to keep all new growth covered with the Bordeaux. The rust is the worst in hot, wet seasons.

There are many varieties of melons differing in earliness, color of flesh, shape and size. The green fleshed varieties are firmer than the salmon fleshed varieties and should be grown on the warmer, lighter soils and for long distance shipping. While the orange fleshed varieties are much richer in flavor, as a rule, but become over ripe and soft, quickly when grown on light, warm soils, they are perfect melons in every respect when grown in a cool location. While it is claimed that some markets are particular in their demands for certain varieties, I find that if the flavor is present it does not matter what the size is or whether it is a green or salmon fleshed variety. Of the green fleshed varieties, Netted Gem, Long Island Beauty and Pollock, are probably the leading ones, while Emerald Gem, Hoodoo and Miller's Cream lead the salmon fleshed varieties.

PEACHES

By W. W. FARNSWORTH, *Waterville, Ohio.*

I am glad to be with you this morning, and bring to you the greetings of the fruit growers of the Buckeye State.

It seems that anything outside of the apple does not receive much attention. I am not jealous of the prominence of the apple; the consumer has been paying a liberal price for the fruit, and it has become so profitable that there may be some excuse for giving it the prominence it has attained. Still, there are other varieties of fruit, both of the large and small varieties that can be made equally as profitable. Take for instance the first of the spring fruits, the strawberry, or, of the larger fruits, the peach, of which I am to talk to you this morning.

The first thing, perhaps in the growing of peaches, is the soil and I fear that in this, very often, has been laid the basis for mistakes. We have been told that the peach will do best in a soil that is poor. I believe this is a mistake, and in the light of our present methods and knowledge, it does better to have a rich soil, although we must be careful not to have too much nitrogen, so as to permit the trees to grow too rapidly, but I believe a good, rather heavy soil is the best. We have there in Ohio the Catawba Island section, which is a low, flat rather heavy soil, naturally underdrained by a layer of sand, which also acts as a conservor of the moisture; and there is also the section along Lake Erie, where the climate is moderate, and where they do not seem to feel the lack of air drainage so much as in some of the inland sections. We realize, however, that the peach will not thrive with wet feet.

In selecting a soil, I would give preference to a soil that is moderately rich, and well-drained; if it is not well drained, it should be made so. In your rolling country, you have an opportunity to select our soils, and in many cases underdrain them by tiles very thoroughly. In selecting a soil for growing peaches, I would like to get a soil in condition to grow a first-class crop of potatoes, and one of the best ways to get it into this condition is to grow a first-class crop of clover and plow it down. We prefer to plow it down in the fall, and plant in the spring.

Some have been using the smaller sized tree. Having had trouble in securing suitable trees, I undertook to propagate some on my own place. They grew larger than any trees I had ever planted, and I was tempted to throw them on the brush pile, but I wanted to plant the trees, and could not get them the size I wanted, so I planted them, and gave some to my neighbors, and they gave me better results than any other trees I have ever planted, and I believe we have been making a mistake in planting the smaller, weaker trees. I don't want an over-grown tree, but one that has enough vigor and constitution in it to make a good, vigorous growth. Of course, in pruning you should prune it back to the single stem, at a height you want the tree. There has been a great deal said about laying out the orchard. We have a very simple way. We simply take the double team and cultivator, and in that way we can lay out the orchard very quickly, and although there may be a variation of one or two inches in a few years it will not be noticed.

The SECRETARY: May I ask whether you are on level or rolling ground?

MR. FARNSWORTH: I have fairly level ground. You cannot lay down any hard and fast rule. That makes our profession better than any other. The carpenter knows that if he makes a rule, the joint will come at a certain place, no matter which wood he uses, but in our work we know that this is not so. I am speaking of my own experience, and my soil is fairly level. On rolling soil this plan might not work so well.

After we have the soil in proper condition, and the orchard laid off, we are ready for planting. See that the trees are received in good condition. We use a low down wagon for our planting—one with crossed reach so that you can turn very easily. If the front wheels clear the tree, the back ones will do it also. We load the trees on this flat wagon, and never leave them exposed to the air any length of time; then we drive on and set the trees in place. The planting is done easily and quickly in this way. One of the points on which many fail, is in leaving too much top on the tree. My idea is that if you can get four or five roots six or eight inches long, it is better than to have a lot of little fine roots. They simply get in the way. Then commence cultivation at once.

The first year raise small crops. In doing this, I would very much prefer to plant vegetables that can be cultivated early in the season. By handling the ground properly, I can get just as much growth as possible early in the season; then by stopping cultivation a short time before sowing other crops that will act as a cover crop,

it will save the moisture in the ground, needed for growth later in the season. The strawberry is objectionable, because there can be no cultivation early in the season. However, we overcame that by throwing a mulch around the tree until the fruit is harvested, and then the berries are plowed.

Now, about pruning; this is a very unsatisfactory subject to talk about unless the speaker has a tree and a pruning knife. We may say, however, that the peach requires much more pruning than any other fruit. It is about midway between the apple and the grape in that respect. We cut out all the useless branches the first year, and cut the tree back about 18 inches or 20 inches. Then we afterward go over it each year carefully, although we do not cut so much as the first year. We think we get a better growth in this way. Then in the spring we go over it carefully and prune so that there will be no two branches directly opposite. If we think we have been a little too easy in the beginning, we cut more sharply. The peach, you know puts out new branches every year, and bears only on the new wood.

My soil, on which I am growing peaches, is a sandy loam, a good deal darker now than when I first got it, because of the humus I put in it. It is a very friable, mellow soil, but I find that I cannot cut back as severely as they can on heavier soil. In my case, I have been obliged to give the trees a little more room than is usually allowed. I would rather have a few less trees and give them the room to spread out, so as to get the sunshine and air and get the proper color, than to have double the number of an inferior quality and flavor. My last orchard was planted 22 x 25, of Elberta and Kalamazoo. This may be a little more than necessary, but I think the tendency is to give a little more room. It was my privilege to spend three or four weeks with the fruit growers of Michigan. The people up there grew peaches on sandy soil, and got splendid results. They gave clean cultivation, but they failed to give the cover crop, and the result was that in a few years the soil was robbed of its humus, and the peaches began to fail with the Yellows and the Little Peach, and in a very short time, the peach industry of Michigan sank to a very low ebb, and to-day there are many less peach trees grown in Michigan than were fifteen or twenty years ago. They are beginning to realize the necessity of keeping humus in the orchard if they want to make a success of raising peaches. It is with the fruit just as it is with the animal; in cold, hard weather, the weak, sickly animal will succumb; and so it is with trees. Our method is to start cultivation early in the season, and cultivate largely the early part of the season. Our time of starting cultivation will depend largely upon the weather, and the character of fruit the tree is bearing. If it is a light, and a rainy season, we often stop the first of July but if it is dry, and the crop is a heavy one, we often cultivate on right up to the first of September.

Now, then, as to the cover crop; in our orchard work we often use oats or barley, preferring barley. We have to use something that will make as great a growth as possible before the winter sets in, and plow it as early in the spring as possible, so that it will not take up any of the moisture that the tree needs. In the case of a young orchard, where we can sow early, we use clover or vetch. We

have been growing vetch for fifteen years. It has a tendency to creep on the ground so thoroughly that it keeps out the frost, and if you can keep it growing in the Spring, it will be of great service.

It has been said that manure is a poison to the peach, but I think that after the orchard is established and has borne one or two full crops, we can very profitably use more stable manure on it than most of us have been doing. This also depends somewhat on the variety. The Elberta will stand more manure than any other variety. As one of our growers puts it, "the Elberta is a hog for manure." In the spring of 1909 I gave quite a liberal supply of manure to an orchard that had borne two or three crops, putting on about fifteen tons to the acre. We had sprayed that orchard the year before for the scab, and it denuded the trees, and to remedy it, I gave them this application. The result was that the growth for 1909 was very satisfactory, and last year we picked over 600 bushels per acre from that orchard, all running very high in quality. So I believe that in connection with the phosphoric acid, we can use larger quantities of the stable manure to supply nitrogen. We use the South Carolina dissolved rock, and apply it at the rate of forty pounds to a ton of stable manure and spread it at the same time. I believe that we get better results by balancing it up this way.

The matter of spraying has been developed largely in the last few years. A few years ago we sprayed only for the Scale, but we find that by using the lime and sulphur, it takes care of the leaf curl. For a long time the rot and spot and scab were very prevalent; then we began to use Bordeaux, using is very weak; we began by using about a pound and a half of the copper sulphate to three or four pounds of lime and fifty gallons of water. But we found at hurt the foliage, and then we learned of the self-boiled lime-sulphur, and we find by its use that we can control all these pests. For the curculio, we spray two or three times with arsenate of lead. The Yellow St. John seem more susceptible to this pest than any other variety.

I want next, to speak for just a moment about thinning. Until recently, growers seemed to think that thinning was all right in theory, but not in practice. I went up to the meeting of the Rochester fruit growers a few years ago, and found some of them rather inclined to sneer at it, but it is something you cannot afford to overlook. It is a good deal more profitable to sell peaches at $2.50 a bushel than at $1.50, and while the consumer may be inclined to grumble a little at first, a week or two later he will remember only the quality. Give them the best and give them a square deal, and they will come back again. I believe that a good many of us are a little inclined to be short-sighted in that respect. We seem to think that if we only get the consumer's dollar it ends there. But it does not end there: we want that consumer to come back to us again, and the surest way we can get him to do this is to give him good value for his money and not overcharge him.

We begin to thin immediately after the June drop because those peaches remaining on the trees take up the moisture and fertility required by the peaches we are going to market. Now, in thinning there is no hard and fast rule to follow any more than there is in

any other line of our work. Some say 6 inches to 8 inches; but the best way is to go into your orchard and look it over, and then get the right distance. Most of us err on the side of not thinning enough, rather than too much. I thin all kinds of fruit in my orchards—apples, peaches and plums last spring, but in the midst of our thinning, cherry picking time came on, and we were obliged to drop everything for at least five weeks and get our cherries off; and at the end of that time, we found that on the trees that had been thinned, the plums were 50 per cent. to 75 per cent. larger, and we got more bushels.

Now, just a few words regarding picking and marketing. I think a great many growers do not do enough work on their fruits to get the best returns. Some growers pick them all at one time. We go over our peaches every other day, and then make several grades of them. It means extra work to do this, but you get better quality, better work, and the consumer is better satisfied. We are better situated for marketing our crop than a great many growers. We are within half a mile of an electric road that gives us unequalled service. They place a car on the siding for us every night, and we keep out fruit in cold storage until evening, and then put it on the car. Early in the season we use the eight-pound basket, like the grape basket, because at that season most of the fruit is used for eating. Later in the season we use the half bushel and bushel basket. For long shipments we use what is called "the seven-eighths basket," which will hold a full bushel heaped up. We grade our peaches carefully, so there will be no bruises. Then in the evening this car is taken out behind the regular car and shipped South. We have found that it is a mistake to depend entirely upon the larger towns. In towns of five to six thousand they have not the facilities to get fruit that the larger cities have, and they are glad to pay the price. Also, early in the season, we go to see the grocers, and arrange with them to handle our fruit; we work for their interest and expect them to work for ours, and it is usually very satisfactory to both sides. One of the firm goes with the car and sees that the fruit goes where it is intended to go, and gets there in good condition. Of course, this is unusually good service, but I think you can easily prevail on your trolley company to give you the same kind of service, especially if there are competing lines near you, or the trolley has a railroad to compete with. You will be astonished to see the number of peaches you can market right near home.

TOMATOES

By C. W. WAID, *New Carlisle, Ohio.*

We will first consider the growing of tomatoes for the canning factory and late tomatoes for city markets. There are limitations to the profitable production of tomatoes at canning factory prices.

One of the most successful growers in our locality discontinued growing for the factory recently because he found that the distance he was obliged to haul, about four miles, reduced the profits to too low a figure. The distance which a grower can afford to haul tomatoes to the factory will depend very largely upon the character of the road over which he must haul. Tomatoes can be grown profitable at factory prices only when the soil is in a condition capable of producing at least 200 bushels or six tons per acre. Even at this figure the profits are small. If 350 or 400 bushels can be grown the profits are very satisfactory. Another drawback to the growing of tomatoes for the factory in some places is the difficulty of securing sufficient labor at picking time.

These limitations will apply equally well to the growing of late tomatoes for the city markets. The labor problem is even greater than when growing for the factory owing to the extra labor required in the cleaning, grading and packing of the fruit. With a given amount of help a considerable larger area can be grown for the factory than for the city market.

We have been growing tomatoes for the factory at $8.00 per ton or about 24 cents per bushel. Our place is two and one-half miles from the factory and twelve miles from a city market. I consider this price comparable with 50 cents per bushel in the city. This difference would be somewhat reduced if we were nearer the city market. It is quite a satisfaction to know that all of the crop is sold even if the price is low as is the case when contracting to a factory.

THE SOIL

Late tomatoes can be grown successfully on a wide range of soils. A sandy loam is perhaps to be preferred to any other type although a clay loam is very satisfactory. In any case the soil should be well supplied with available plant food and organic matter. A poorly drained soil is to be avoided as is one that dries out too easily. An application of stable manure supplemented with phosphoric acid and potash and in some cases nitrogen will increase the yield on nearly all soils. The amount of manure or commercial fertilizer which it will be profitable to apply will depend on the previous treatment of the soil. When the soil is rich and full of humus the application should be comparatively light as too much available plant food in the soil will grow vines at the expense of fruit. With us the Stone is grown more than any other variety. If it could be bred or selected so that it would begin bearing two weeks earlier it would be an ideal tomato for the factory or city market.

There is no greater mistake made in connection with tomato growing than the setting of small spindling plants. This mistake is more commonly made by those who grow for the factory because of the poor facilities which they frequently have for the growing of the plants. When the factory people raise the plants themselves they often grow them too thickly and thus send them out in bad condition.

Another serious mistake is the carelessness about the source of the seed supply. When the company furnish the seeds they often

purchase them at the lowest price possible. The idea seems to be common that any quality of seeds that will grow is good enough. At most the seeds for an acre cost very little and the best obtainable are none too good. Another cause of serious loss in our locality is the lateness of the setting of the plants. The season with us is not long enough to mature all of the fruit on late kinds and a delay of two or three weeks in planting means a big loss in the fall.

We sow the seeds for our late tomatoes about March 15th. As soon as the plants are large enough to handle they are pricked out into flats about two inches apart. When they begin to crowd they are transplanted either into two-inch pots or into flats again but given more room. If potted the pots are plunged into soil between the tomatoes in the greenhouse. Plants grown in this way are stalky and can be planted with a tobacco planter or by hand. We set four acres to this kind of plant in one day last season with the aid of a tobacco planter. No water was used as the soil was in a moist condition. The ground had been marked one way and the boys dropped the plants in the marks. They did a much better job than I expected and while it was some more trouble than it would have been to have rowed them only one way it was a decided advantage to be able to cultivate them both ways. Nearly every plant grew thus we secured an excellent stand.

When the plants are small the cultivating is done with a two-horse cultivator. After the vines begin to spread we cultivate with a one-horse cultivator once in a row. We cultivate to conserve moisture as well as to destroy weeds. If the cultivating is done at the right time and frequently enough no hoeing and little weed pulling will be required. If the soil becomes cloddy on the surface it is a good plan to run through the spaces with a plank drag. Women make good pickers and boys and girls can be used also if an older person is with them. We pick in baskets and empty into crates. A flat hay rack or ladders as they are sometimes called, mounted on a low wagon makes a good conveyance for hauling. Springs should be placed under at least one end of the rack. In hauling tomatoes long distances they carry much better in small baskets than in bushel baskets or crates.

EARLY TOMATOES

The profitable production of early tomatoes has greater limitations than the profitable growing of late tomatoes. Early tomatoes can be grown successfully only on certain soils. Besides the requirements which were mentioned for late tomatoes the soil should be what is popularly called an early soil. A sandy loam with a southern exposure is generally considered best for early tomatoes. Clay soils are not well adapted to this purpose. It is also important that the location be near a good market or shipping point. Unless the person who grows early tomatoes has a greenhouse or hotbed in which to start the plants or can buy them already grown in one of these places his chances of success are slim.

It is of even greater importance that good seed be secured for early tomatoes than for late. We should not only have a good variety but the best strain of the variety we select obtainable. In my judgment there is much yet to be done in the way of improving

the tomato. We may not need new varieties but we do need better strains of the best varieties now grown. Have you ever kept a careful record of the yield of a number of plants of a variety grown under similar conditions? If not try it and see for yourself what a variation not only in total yield but in time of ripening these plants show. Some plants will ripen all or a large part of the fruit at one time and early in the season while others will ripen the bulk of their fruit late in the season or a little at each picking throughout the season. Some plants will produce two or three times as much as other plants adjacent to them. Is this all due to variation in environment? Much of it may be due to soil variation but I am confident that some of it is due to what we call inherent tendencies or the power of the plant to reproduce itself without respect to its surroundings. When we save seed from a fine tomato which has been selected from a basket of fruit we may be getting just the kind of seed we do not want. We often find the finest specimens of fruit on vines which have very few fruits on and are therefore not productive. When we select specimens to save for seed from a basket we know nothing of the character of the plant from which they come. It is very important therefore that we take into consideration the entire plant when making selections for seed or our work will be useless. If we expect to do thorough work in the way of improving the tomato by selection we should save seeds from a few specimens of several apparently productive and otherwise satisfactory plants and test them out for seevral seasons much after the plan followed by the corn breeders in their ear-to-row work. The fact that tomatoes can be propagated from cuttings and thereby kept pure should be of great help in this work.

Where a strictly early variety is wanted it is doubtful if there is anything superior to the best strains of Farliana. For medium early the Beauty is a first-class purple sort and Chalk's Early Jewel a good red tomato.

We grow the plants of the early varieties in much the same way as we do the late sorts except that the seed is sown two or three weeks earlier. In transplanting the second time the plants are set in four instead of two-inch pots. This enables them to grow to a larger size without becoming pot-bound. The plants are removed from the pots at the greenhouse when we are ready to plant them and hauled to the field in flats made from glass boxes.

The last two or three seasons we have had long spells of cold wet weather after some of our early plants were set in the field. The plants set after the cold spell have always done better than those set before. From this experience I have come to the conclusion that it is not always advisable to be in too much of a hurry to get the plants in the field.

With us there is not as much staking of tomatoes as was practiced a few years ago. The scarcity of help recently has no doubt had some influence along this line. Where it is not necessary to economize space mulching with straw will answer much the same purpose as staking. The mulch will keep the fruit clean and at the same time conserve the moisture. One of the drawbacks to the use of mulch is that it affords a hiding place for crickets and other insects which perforate the skin of the tomatoes and render them unsaleable.

GREENHOUSE TOMATOES

Tomatoes may be grown in the greenhouse the year round if desired. A few of the Ohio vegetable growers devote a part of their houses to tomatoes each fall. They aim to have them ripening at least by Thanksgiving time and in some cases considerable earlier. It is important to have the plants and fruit as well quite fully developed before the usual dark, cloudy weather of winter sets in. Tomatoes require sunshine for their best development but when the fruits have attained their normal size they will ripen even in cloudy weather. The plants of the fall and early winter crops are allowed to produce fruit as long as they give profitable returns. Such seasons as the present when we have so few clear days the fruits ripen very slowly but on the other hand prices have been good, partly as a result of the slow ripening.

A much larger area is devoted to tomatoes in the spring and early summer than in the fall. We do not grow any in the fall but make a specialty of spring tomatoes. Tomatoes are a very satisfactory crop to grow under glass when weather conditions are favorable as is usually the case in the spring. There is a beauty and quality about greenhouse grown tomatoes which makes them superior to those grown in the field even when the field grown fruits are allowed to mature before being picked and there is a very wide range of quality between the greenhouse tomatoes and those which are picked green as is usually the case, of necessity, with southern grown tomatoes. Those who know the difference in the quality of greenhouse grown and southern grown tomatoes are always willing to pay much more for the former. We have been able to get $2.00 per bushel for greenhouse grown tomatoes when early homegrown field tomatoes would not bring over $1.50.

VARIETIES

There is quite a difference of opinion among growers as to which varieties are best adapted to forcing. It should be understood whenever this subject is under discussion that the varieties which are suitable for spring and early summer forcing may not be satisfactory in the fall and vice versa. The small fruiting varieties are the best for fall forcing as the markets at that season demand small fruits. In the spring larger fruiting varieties can be grown as the prices are not as a rule as high as in winter and thus the trade is not as particular as to size. The small fruiting sorts produce such very small fruits toward the close of the season that they do not sell well when they are forced to compete with the larger fruits from the south and the local field-grown crops. The fruiting season in the greenhouse with us extends from June first to August fifteenth, thus we must sell in competition with southern-grown tomatoes from the start and with local field-grown tomatoes toward the close of the season. Our list of varieties this year consists of Magnus, Beauty, Globe, Stone and Grand Rapids Forcing.

STARTING THE PLANTS

We have found it necessary, owing to the very dull winter weather which we have experienced the last two or three years to sow the seeds soon after the first of November. If half or more of the

days were fair it would not be necessary to start the plants until about December 1st. We aim to have the plants ready to set in the permanent beds about March 1st. This brings them into fruiting about Decoration day. In some localities it would no doubt be better to gets the plants in their permanent places earlier but with us February is usually a pretty cold month and we prefer to keep the plants in the plant house until the worst of the cold weather is over. Then too we plan to have the second crop of lettuce coming off the last of February and first of March and the tomatoes are set with the third crop of lettuce.

The plants are transplanted three times the same as for early field-grown tomatoes. When a crop of lettuce is grown with the tomatoes it is best to have the lettuce started before the tomatoes are set in the beds, but this cannot always be done. The lettuce should not be allowed to crowd the tomatoes too much as it will make the plants spindling. Lettuce grown in this way will be light in weight but the returns usually justify the effort necessary to produce a third crop.

The tomato plants are set about eighteen by twenty-one inches apart. A home-made wire, twisted into corkscrew form at one end and looped at the other is screwed into the ground by the side of each plant. Wires are stretched the full length of the greenhouse directly over each row of plants and above the truss rods which support the roof. A string is fastened to the loop below and tied to the wire above. In training the plant up they are twisted about the string or tied to it with raffia or both. All suckers or side branches are broken off when small. Only one stem is allowed to grow to each plant. Our beds are six feet in width thus four rows of tomatoes are set in each bed. This makes it very convenient or work with the plants when pruning, pollinating or picking. It is not advisable to set closer than this distance and some growers prefer two by two or even two by three feet.

POLLINATING

As soon as the blossoms commence to open hand pollinating begins. We use two sticks about 18 inches in length for this purpose. One stick has a spoon shaped end whittled into it and the other a spatula at the end. To pollinate the ladle is held under the flower and the blossom tapped gently with the spatula. This jars the pollen into the ladle and when a sufficient quantity of pollen is secured to show in the ladle the flowers are pushed into it until the end of the pistils touches the pollen. The releasing of the pollen and the placing of it on the pistil is done in one operation after a start has been made. We aim to go over the plants every other day and all of the blossoms which are fully open are treated at each operation.

There is a good deal of difference in varieties as to the need of hand pollination. Some varieties will set much fruit without any hand pollinating while others will set almost none. When the blooming period comes at a time that will permit of wide open ventilators much of the time hand pollinating is not so important as when the houses must be kept closed or nearly so a good deal. We think it safer to do a little more work than necessary than to run the risk of heavy loss through a small saving in labor. Care

should be taken to do the work with as little injury to the pistil as possible as rough fruits often result as a neglect of pollinating or from careless pollinating.

PICKING AND PACKING

The picking is done three times a week. Only the specimens which are nearly or fully colored are picked. The grading is done on a bench made for that purpose. Two grades are made and all fruits which are included in the first grade must be smooth and not below a certain size. The second grade is made up of fruits too small for seconds but not too small to be marketable and those that are a little rough but not rough enough to make them unsightly. It should be said in this connection that greenhouse-grown tomatoes are much more liable to be rough than the same varieties grown in the field.

We pack in small baskets similar to those used by many southern growers weighing out five pounds in each basket. These baskets are packed in crates made to hold four baskets or twenty pounds. This is a neat package but is adapted only to warm weather shipping.

We seldom get more than $2.50 per crate nor less than 75 cents and that only at the last of the season. Two pounds per square foot of bench space is considered a good yield. The supply of southern tomatoes on our markets governs the price which we are able to get for the greenhouse stock to a considerable extent but when the trade has once learned to know the difference in the quality of the greenhouse grown and southern grown tomatoes, there is little difficulty in disposing of it at quite an advance over the southern stock. The markets could handle to advantage many times the present output of greenhouse tomatoes.

STRAWBERRIES

By J. W. KERR, *Denton, Md.*

No other fruit plays so diversified and inconsistent a roll as this. Under, even ordinary management, it is renumerative to the grower and most acceptably increases his revenues wholly independent of the tariff. It presents itself at a season of the year when its refreshing acidity is an unfathomable joy. In communities where grown on a large scale, it becomes the innocent disorganizer of the household and a harassing family nightmare. Two cents per quart for picking presents a temptation that mobilizes and leads to the barracks hastily improvised for them all the house help, for miles around, without limitations as to color, nationality or religion; nor does it stop at robbing the housewife of her help, but all too freqently, able bodied men hired by the year to work on the farm, suddenly fail to answer the roll call of their employers, and hie themselves with their wives and children to the berry fields. It is quite natural, when house-hold customs and out-door interestes on the farm both are so severely jolted, that the cause should be severe-

ly criticised and denounced; but that little blushing sinner of a strawberry just keeps on covering itself with blushes, so as to better its chances to imitate the smart country girls and boys that are swallowed up in the large cities.

"Between the bays" the strawberry (to put it accurately) is exploited rather lavishly. From one, to one hundred acres of strawberry plantation, under the management of one man; and inconsistent as it may appear on its face, the larger the acreage, the more thorough and business like, from start to finish, is every detail and essential, which as a rule, at the final wind up of the season, writes the broad strawberry smile on the Christian-like countenance of the man behind the check book.

The large growers by force of circumstances, affecting soils more particularly, but market peculiarities to some extent also, may differ in the minor lines of procedure, but in the great essentials of the work their operations are in exact accord. In explanation one grower may possess a liberal acreage, that nature has fitted in important particulars, for the successful growing of some varieties,—fastidious in soil requirements; and such kinds,—to the exclusion of varieties more generally adaptive to different soils, are most successfully and profitably utilized. Again, the grower may not have on his farm, the kind of soil upon which such varieties can be depended upon, for a good and profitable yield. Ask this grower to explain the absence in his plantation of such kinds and he will truthfully tell you that they don't pay him. In the county where I live there is one of the largest growers on the peninsula—a man noted for his enterprise, and clear-cut business thoroughness; this man grows and picks from twenty to thirty acres annually of the Gandy, a late variety that will never disclose its full capabilities unless on a moist rich soil. The gentleman I have in mind bought such land adjoining him at a nominal figure, because it was wet and swampy and overgrown with bushes. Cleared up, and a good system of underdrains installed, make it ideal land for growing the Gandy strawberry to perfection. There are other late ripening kinds that doubtless are more satisfactory on land affording less moisture, but on somewhat low, dark, loamy soil, with clay subsoil, the Gandy holds the Blue Ribbon.

None of the large growers so far as I am aware use the planting machine for setting their plants. While for certain kinds of vegetable plants this machine is used to some extent, strawberry growers prefer the disk marker to open the rows; setting the plants by hand to the bar side of furrows thus prepared. That plan of cross marking the land and setting the plants at the angles of the squares, sufficiently distant from each other to permit the passage between them of a narrow cultivator, and cross cultivating, while it lessens the expense of hand hoeing considerably, is making no great gains in popular favor. What is everywhere known as the matted row plan is given the preference. With the strawberry, as with all other fruits; results are dependent upon the efforts bestowed in their production. In the matter of cups and crates, wonderful progress has been made. Did the strawberry growers of to-day have to pay as much for cups and crates as was the case fifty years back, their business would promptly collapse. Think of it—$30 per 1,000

for quart cups; $2.00 each for thirty-two quart crate. The gift quart cups at that period could be had at ten dollars per thousand in the flat, the growers putting them together themselves. Under present conditions the forty-eight quart crate is most popular and is furnished, including the forty-eight cups and divisions for less than forty cents each. The old go-as-you-please plan of shipping, every man for himself, single handed, bush-whacker like, had a much longer lease of existence than it deserved. Metaphorically the tail had to wag the dog before escape from the old growers was practicable. Almost at the extremity of the peninsula a few years ago, a fruit and vegetable exchange was organized and conducted on sound business principles. Results were a genuine revelation. To-day branches of that exchange in nearly all the peninsula counties are substituting system and method for the "Any-way-so-you-get-there" practice that formerly attenuated the bank accounts of the shippers. These exchanges are in constant touch with the market conditions of all the cities and large towns that are in timely reach of perishable products, and the goods have daily consignment to points where prices are most inviting. At some points strawberries, as well as other fruits, are sold at public auction by the exchange, thus introducing a mild form of speculation, that imbues the buyers and the growers with the excitement of expectancy. The loaded wagons are driven to the stand of the autioneer, the berries are hurriedly examined by the buyers that locate at these points. If the bids are satisfactory the grower accepts and returns home with the money for his berries in his pocket. If the grower suspects ony understanding among the buyers to co-operate in fixing prices, they slip through the exchange instead of selling at the railroad station. The inauguration of these long needed reforms insures to every member of such exchanges a fair and just value for his fruit. If it is extra fine in quality and condition, the quick perception of the buyer is prompt in acknowledgment. On the other hand, where fruit grades low, the grower receives a very impressive admonition to mend his ways.

We sometimes read of marvelous results and achievements by special methods of cultivating or growing this fruit; and while such sensational revelations may be true in a prescribed sense, when the entire story is told, instead of inspiring the confidence that would beget widespread invitation, it is soon lost in the flitting shadows of forgetfulness. In localities where the growing of this fruit is made a business, every principle of economy and progress is worked out in finest detail by men whose financial prosperity demonstates quite clearly that they not only excel in the business requisite but also that penetrating and comprehensive study of plant nature, that insures to each variety, situation and soil fertilization, such as its individuality craves, and must have to make it profitable. By the unerring scales of practical test, they determine the value of novelties, and the new variety is thus accurately analyzed as to its merits. Where plant growing as a business proposition is not combined with fruit growing, a very small per cent. of the annual new productions are observable. You find that disturbing desire for new kinds far more pronounced and conspicuous among the small growers than those higher up. The advent of the Hovey back in the thirties,

though a postillate, was a long stride forward in American strawberry development. The introduction of the Peabody in the fifties triumphantly marked a great epoch. This fact was especially noticeable in its relation to the breeding or originating of new varieties. The five dollars per dozen for plants, as received by the propagators, who got in on the ground floor, when the Peabody tide was at its flood, caused many who were horticulturally inclined, to see visions, and to dream golden hued dreams, when they were not sleeping. A steady shower of new varieties began to fall upon the public; tinted by the glittering crystals of beguiling hopes, and the fasinating charms of unbridled expectancy, hundreds of these little innocents still in their swaddling attire of gorgeous tinsel, were adjudged and condemned as horticultural "goldbricks." They simply made a faint and brief little twinkle, and were promptly replaced by that same shower which seems as though it might "go on forever."

In Fuller's small Fruit Culturist, published in 1867 there are named one hundred and twenty odd varieties of strawberries of American origin. In a revised edition of this work, published fourteen years later (1881), the same author only names ninety-four varieties. In neither list is there a variety named that is regarded as profitable or desirable by the successful growers of the present. In 1867, Orange Judd and Company published the first volume of their horticultural annul or year book, and in the Introduction by the editor this sentence occurs: "We differ as much from Europe in our horticultural operations as we do in other matters, and it will be a long time before we attain—if we ever do—that state of refinement that comes of a dense population, cheap labor, and great individual wealth." I take it that the word refinement as it appears in that somewhat remarkable sentence has reference to our horticulture only. Be it so, and what do we behold as we look through the Kaleidoscope of progress during the interval between 1867 and the present? Surely the great wealth of individuals no longer bars us from full participation in the ennobling distillations of that European refinement in horticulture. If growing a car-load of strawberries where but a crate was grown in 1867, and distributing the same, at prices so as to make them available to the pent up residents of all our large cities, if this tends toward refinement, our American horticulture is giving its European cousin the busiest time in its history, to maintain its supremacy. If however, a refinement of our horticulture is in any way dependent upon a pauperized condition of labor, it is infinitely preferable that it continue in its plebeian vulgarity. While the standard of excellence as to quality and size has made little if any advancement in strawberry culture, during the last half-century there centainly has been marked progress in meeting and supplying the essentials for field culture, in varieties embodying size, firmness and productiveness; features that vitally affect the interests of growers for distant markets. This question of varieties at best is so very local and circumscribed in its nature, that it resolves itself into a problem to be correctly solved by personal or individual experience only. The general and fixed peculiarities of the plant render it sensitive to any lack, or uncongeniality in soil conditions. One variety proves a rank failure where another is every way satisfactory, while perhaps not a mile

distant the conditions as to behavior of the same varieties may be just the opposite of this, so that any discussion as to varieties is likely to develop as many sides to the question as there are growers present. When a grower has varieties that are adapted to his soil and situation he betrays a business weakness when by the glamour and glare too common in the introduction of novelties, he is induced to slight or neglect the known, for the specious uncertainty of the unknown. There is a difference, far reaching in its importance, between the commendable principles and spirit of enterprise and progress, as compared with that universal human thirst for change.

IMPRESSIONS OF PENNSYLVANIA FRUIT

By G. B. BRACKETT, *Pomologist, Department of Agriculture, Washington, D. C.*

My impressions of Pennsylvania fruit date back to 1876 when I had charge of the Pomological Exhibit at the Centennial Exposition. My attention was there first called to the wonderful productions of Pennsylvania orchards.

My connection with the Exposition required my attendance from its opening to its close, consequently it gave me an opportunity of examining fruit as it was placed on the tables beginning with the ripening of small fruits and continuing throughout the season until September when the great exhibit of tree fruits was made. It was the finest exhibit of its kind ever held in America up to that time. Twenty states as well as Canada and foreign countries were in competition.

Twenty prizes were awarded to Pennsylvania exclusively on her fruit exhibit. The apple was by far the most important fruit. The most popular varieties of this fruit exhibited at that time were Williams, Red Astrachan, Maiden Blush, Summer Queen, Porter, Fameuse, Gravenstein, Lowell, Jonathan, Baldwin, Yellow Bellflower, Swaar, Rhode Island Greening, Roxbury Russet, See-no-Further, Gilliflower and Tallman (Sweet).

I find only seven of the above mentioned varieties on your premium list, thus showing the great changes that have taken place in the last 35 years.

Among the many valuable varieties found on your exhibition tables are some that deserve special mention:

York Imperial is perhaps one of the most profitable varieties grown in your State and also southward throughout the Blue Ridge and Appalachian region in Virginia, West Virginia and North Carolina. It also grows to perfection in the Middle West, where it finds a ready market in Chicago and other cities of the Mississippi Valley.

It may be of interest to note here that Pennsylvania has originated on her soil 285 varieties of apples of which York Imperial is among the number. As most of you know, the tree was a chance seedling found by Mr. Johnson on his farm in York county; find-

ing it to be of attractive color and a good keeper, he got Mr. Jonathan Jessop, a nurseryman, to propagate it. Mr. Jessop thought well of the variety and named it Johnson's Fine Winter. He sent a basket of the fruit to the late A. J. Downing, who pronounced it "the imperial of late keepers," and as it originated in York county, Mr. Downing suggested the name of "York Imperial," an appropriate cognomen for this valuable commercially variety. It is now one of the leading varieties in many sections of the country where it brings large returns to the grower.

Mr. J. N. Craig of Rose Cliff Orchard at Waynesboro, Virginia, and Commissioner Koiner of the Department of Agriculture, Richmond, Va., report an orchard of York Imperial, ten years old, 4 acres, that yielded the comfortable return of $2,000 the past season.

The Stayman Winesap is one of the most promising varieties now being planted in commercial orchards. It has been found to succeed over a very wide area of country extending from the Atlantic to the Pacific. It originated in Kansas from where it spread first eastward and then westward. The tree is a vigorous grower, very productive of large fine fruit of good quality and it is justly entitled to the reputation it has gained.

Jonathan and Grimes' Golden stand at the head of the list of choice varieties, especially for quality, for which they always command the highest market price.

There are several varieties that might be mentioned that are well adapted to soil and climate conditions of many of the counties in Pennsylvania.

I fail to find any mention of Rome Beauty on your fruit lists. Just why you have omitted this is a question I cannot solve. In my estimation it should rank with York Imperial, and though not so prolific, it comes into bearing early and its quality is better than York Imperial; and it is the ideal apple tree for sandy soils.

The question of varieties to plant is one of paramount importance. In times past little attention was paid to this matter, but in recent years it has been the subject of very careful investigation. It was partly for this object that the American Pomological Society was organized. And for this purpose, by means of extensive correspondence with fruit growers all over the United States and Canada, data has been obtained upon which the Pomologist of the Department of Agriculture at Washington has been enabled to publish in pamphlet form, a list of varieties of fruit adapted to the various sections of the United States and Canada. It is known as the Revised Catalogue of Fruits and the publication is revised from time to time in order to keep pace with the progress in Pomological Investigations.

I cannot urge upon your growers too strongly the necessity of planting varieties adapted to your soil and climate. If mistakes are made in cultivation, spraying, pruning and such things, they can be corrected the following year, but if mistakes are made in the selection of varieties it means a loss of seven or eight years' time which no one can afford to lose in the short space of a life-time.

A mistake very often made is in planting too many varieties. Four or five of the very best sorts that have been tried and known to succeed in the locality where the planting is to be made, are sufficient for a commercial orchard.

According to the Census of 1900, Pennsylvania is one of the great apple-growing states, ranking third in total value of all kinds of fruits. It is probably safe to say that there is not a county in the State of Pennsylvania in which some kind of fruit cannot be grown with profit. It is needless to state here the different kinds of fruit that can be profitably grown in the different sections of Pennsylvania. You can decide better by what has succeeded best in any locality, what is likely to be the moneymaker in a given section. Since the Census of 1900 when Pennsylvania ranked second to New York in her apple crop, great changes have taken place, and more attention has been paid to up-to-date methods of orcharding.

A new interest in orchard growing has been awakened. Hitherto a large percentage of the fruit crop came from the home orchard or small commercial planting; now under the new impulse large plantations are being started and Pennsylvania is keeping pace with her sister states in the great movement, and her possibilities, it is safe to say, are unsurpassed by any of them, but if she would keep up with the procession she must adopt the improved methods of the times, in all the details of culture, pruning, spraying, thinning, harvesting, grading, packing and marketing the fruit.

Intensive versus extensive culture is the watchword. Eternal vigilance is the price of good fruit. The old method of planting an orchard and trusting to providence to take care of it is a thing of the past. Much depends on the man behind the enterprise. Success in fruit growing is not the result of chance or accident. It means the exercise of brain and muscle; it means business in every sense of the word.

However much you have done in fruit culture, recent statistics show that your orchardists fall far short of growing sufficient fruit to supply the great home demand, and large quantites are shipped in from other states. With this condition existing and with the wonderful possibilities of fruit growing in Pennsylvania, it seems to me that there never was a time in the history of the industry so favorable for orcharding as at the present, when viewing this subject from a commercial standpoint.

With the favorable climatic and soil conditions of Adams, Berks, Lehigh, Lancaster, Lebanon, Montgomery, York and other fruit growing counties of your State, and with such fine markets as Pittsburg, New York and Philadelphia right at your doors, there is every incentive to further the progress of fruit growing.

Next to the long list of apples that originated in Pennsylvania comes the list of pears consisting of fifty-two varieties of which the most valuable variety of all is the Sickel.

Your Horticultural Society is one of the oldest, having been organized in December, 1827; since then nearly all of the territory west of the Mississippi River has been settled and made into states whose populous cities teem with varied industries.

Your Society has on its roll of honor such names as Meehan, Landreth, Hoopes, Warder, Barry, Fox, Wilder, Parsons, Parry, Thomas and other distinguished pomologists, many of whom have passed to the Great Beyond. I would urge the young men of your State to take up the great work so ably begun by these illustrious pomologists for orcharding is a pleasant and profitable occupation.

To go back to the exhibit over here. I have not had time to make the notes I would like. My time was so taken up judging the fruit that I did not have the time to make the notes I wanted. In looking over the county displays, Perry, Adams and Luzerne have wonderful displays of almost perfect fruit—especially Adams. I trust you will pardon me if I make any personal allusions. Adams county makes the best display of any county. There is scarcely an imperfect specimen there in the way of the codling moth.

Lewis Brothers, of Luzerne county, have one of the most remarkable exhibits in the hall. Every one can see the fruit for himself, and know what it is by the label. This exhibit was not in competition with the others, but it is a noteworthy exhibit.

In some of the exhibits I find the Spitzenberg, which used to be grown years ago, but has lately been dropped almost entirely. It is a high quality, and very valuable. There are four boxes of apples over in the hall that come nearer perfection in grading and packing than anything else there. I find some varieties that, perhaps, have not been tried, but of the tried varieties there is the Rome Beauty, growing in many parts of the country. In Ohio, where it originated, it has become nearly perfection, and judging from the specimens I see over here, it will become one of the leading varieties of this state. Next comes the York Imperial.

By the way, I must not pass by a very fine exhibit of pears, sent in by your worthy President. He says it is due to cross-pollenation. That is something that he never seen fully established before, but if this is the effect, it is something to know and make use of.

The Banana apple, which is coming into notice, originated in Indiana, from there into Michigan, and from there into the Northwest, seems to be doing as well here as out there. It is quite a choice variety, and I hope to hear further reports from it.

There is one thing I wish to call your attention to in regard to the Jonathan. There is a disease which has lately shown itself in the way of spots on the skin; they are only skin deep, but it detracts from the market price of the apple. They do not know yet exactly what it is. The first time my attention was called to it was when a man came clear on to the city of Washington from the state of Washington. He had sent a carload of fruit there. It was sent by the way of Pittsburg and distributed through a commission house at Washington, and he received complaint of these spots, which it was supposed had developed while in storage. They showed me some of the specimens, and my impression was arsenical poison, which did not show itself at the time, but developed while the fruit was in cold storage. I find among your apples quite a number of specimens affected in this way.

Now, you are aware that there has been a tremendous impetus given to fruit-growing throughout the country. I think that Pennsylvania is to-day quite close up with other states. I have been watching this impetus, especially in connection with Virginia and West Virginia, and I suppose you, in your state, are doing the same thing. Now, I don't want to hurt your feelings any, as fruit growers, but I want to tell you that you have not yet attained to the high water mark in fruit growing. Now, if you will look over the display you will find a number of specimens that could have been

improved by spraying, and you will find this, especially, in parts of the country where they have not had any education along this line. Then, in grading and packing you fall short. There is scarcely a box or a barrel on exhibition that would stand the test of the Hood River district. Out there they have specialists to do their packing. No man is allowed to do his own packing, so as to detract from the uniformity of the fruit. It is quite an art to pack fruit properly and carefully and nicely. Now, if you will go over and look at the boxes there, and then at Lewis Bros. box, you will see the difference. Some of the boxes are not more than two-thirds full, and in no way can they come under the head of first-class packing.

Then there is another thing you will have to have your attention called to here. You spray for moth, and for the San José scale, but you do not prepare for frost. If you realize that the cold air settles at the bottom, you will have your orchards in such position that the cold air can escape without injuring your blossoms in the early spring. There is no telling what you may have to overcome in this method of damage by frost. I have written out a few notes here, which, if you can spare me a little time, I will read:

Among the most wonderful achievements in the progress of horticulture in recent years is the discovery of means for the prevention of frost injury to fruit trees during and after the blossoming period. The danger to fruit trees by frost injury is not so great during winter months, but when the tender blossoms appear there are a few days in spring time when the weather is apt to be capricious.

It is perhaps safe to say that at least 40 per cent. of our crop of fruit is cut off annually in the spring of the year by frost. In some of the commercial orchard districts this disaster has occurred so frequently year after year that thousands of acres of orchard trees have been abandoned and are being cut down to give place to other crops. In this age of invention it is not wise to attempt to set bounds or limits to the ultimate power of man to overcome the forces of nature or to modify and change atmospheric conditions. There is little in the way of man's achievement that seem hopelessly impossible. Already it has been fully demonstrated that the temperature of the air can be raised a number of degrees by artificial means. Many devices for orchard heating have been invented and are now on the market.

From the abundance of testimony already obtained from reliable sources in all parts of the country, it is safe to say the prevention of frost injury to fruit crops has already passed the experimental stage and has become a well-established fact that cannot be controverted or lightly passed by. For the past three or four years practical tests have been made in Colorado and other western states, with perfect success. We have reports of many remarkable instances where thousands of dollars have been saved by the use of heaters. A single case in point will perhaps be sufficient. Mr. C. E. Mincer, of Hamburg, in reply to questions put by the Editor of the Missouri Fruit Grower in November, 1910, as to why he prepared for frost fighting, says:

"We lost several crops of fruit by frost and we either had to save the fruit or get out of business. In one year, while experimenting with means to prevent frost losses, we saved 6,000 bushels of peaches by burning brush in the orchard, and another year we saved a part of the apple orchard by the same means. The success we had with burning brush led us to equip a portion of our orchard containing 900 bearing apple trees with 1,000 of the small size Troutman orchard heaters. We also constructed a large storage tank that would hold several tank-car loads of oil and obtained an outfit of wagons, buckets, lighters, etc. The concrete storage tank is constructed of reinforced concrete and holds 16,000 gallons. The tank is all below ground and over the top is arched steel bedded in cement. An 8-inch man-hole is left in the top so that it may be entered at any time when necessary. The bottom of the tank slopes to one corner where it opens into a two-inch pipe that leads down hill to a point where easy loading in the wagons can be affected. The unloading of the tank car is done by gravity and by taking advantage of the slope of the land; the handling of the oil is also done by gravity when reloading the wagons. The oil is thus handled easily and quickly.

"The orchard pots or heaters must be managed so as to light quickly. We did not try to light the pots till the temperature dropped below thirty degrees. We did this to economize on oil. However, when the temperature reaches thirty-two degrees in any orchard, the oil pots should be lighted. And, if a period of 24 or 36 hours has elapsed after the trees have come into bloom the fertilization will probably be completed.

Records of Temperature. "The first night of the frost was April 16th. On this night the temperature was at 34 at 9 P. M. At midnight it had dropped to 27; at 3 A. M. it had reached 23 degrees and at 4 A. M. it reached the minimum close to 22 degrees. Inside of the orchard where the fires were burning, the temperature at this hour was 33 degrees in some places and 32 degrees in others. Outside of the orchards the temperature did not reach 32 degrees until noon the next day. On this night the wind was blowing so hard that it was difficult to pour the oil from the buckets into the pots. It must be poured into burning pots slowly or it will put out the fire. And to make the work doubly difficult on this night it was snowing hard and the melting snow in the pots caused the oil to sputter and pop from the pots, wasting a great dealt of it.

"On Thursday night, April 21st, we had the most convincing test of the value of smudging with oil heaters. It was a clear night and still, and the temperature in the evening dropped to 28 degrees, reaching a minimum of 25, where it remained until 9 A. M. the next day. We lighted one-half the pots and watched results. A dense black smoke formed over the orchard and surrounding fields. The tem-

perature outside of the orchard was 25 degrees and inside it was 36 degrees. Outside the orchard everything was covered with thick, white frost, while inside the trees were dripping wet with moisture.

"In all we burned the oil pots nine nights, and the time ranged from five hours to twenty hours in each twenty-four. At the last the temperature would drop about four o'clock in the morning to freezing point and frost a little. We would light about one-third of the heaters and let them burn until past the danger time.

"The expense of heating the orchard this past spring was approximately 7 cents a bushel for the apples harvested. This includes the expense of equipment for the work building, the oil, storage tank, the tank wagons, lighters, pots, buckets and enough ready oil on hand to fight another season of frost equally as bad. So that the actual cost the past season was far below the 7 cents mentioned.

"The cost of this protection is so cheap compared with the returns that it is absolutely folly for the fruit grower not to be prepared. The type of pot used was the Troutman, which was selected after much investigation from a number of sources, and we doubt if we could have made the successful fight with any other kind of oil burning pot."

There are thousands of acres of good orchard lands in your State and the awakened interest in fruit growing among your people will result in that successful orcharding that tends to make happy homes and increased revenue.

It is a great pleasure to me to meet with you and see what you have been doing along this line. I like to keep in touch with the fruit growers all over the country. Last week I was judging at the Ohio apple show, which, by the way, was a wonderful show. Last fall I was at Denver. As you know, that is one of the finest fruit-growing countries in the world, and fruit growing has become one of their most important interests. Some of the fruit I had to judge out there was what they call "jumble-packed." They put in a layer at the bottom, then put in the apples, with another layer on top. Every section has its own methods, but eventually they will all have to adopt the methods of the Northwest. The buyers demand it. I will give you an instance of this. A grower of Virginia who grows some very fine Winesaps, shipped some of them to New York, packed in boxes the same as they do in the Northwest and the dealer wrote him that if he had left his name off the box, he would have sold them for Northwestern fruit.

Now, I have said enough on this subject. I know the next time I come here I will find still further improvement in the growing of your fruit—in the spraying, in the pruning, but especially in the matter of grading and packing, which is one of the most important things. It is better to keep at home all your imperfect fruit. It detracts from the value of your fruit if sent to market. You, perhaps, think all the Western fruit is like that you see here. It is not so. What we see here in the East is perhaps not one-half of their fruit, but they can not afford to pay freight on their im-

perfect fruit. You are 3,000 miles nearer the market than they are, and I think that going to the West is a step backwards. Within the last few weeks I have had three inquiries from Western men who want to sell out their fruit land and come East to raise fruit. They ask me where they can find a good location. There are still large sections here in the East, particularly in Virginia and West Virginia, that can be profitably used for fruit growing, and I suppose it will be so for some time.

ORCHARD MANAGEMENT

By W. W. FARNSWORTH, *Waterville, Ohio.*

When I first began thinking of horticulture, and began to plan changing over from general farming to fruit growing, I was doing considerable work in the woods. I have always been a lover of trees, and a lover of the soil, and I realized that this new ground when the plow first went into it, was rich in humus, and when I compared it with the richest land I had for fruit growing, I saw the difference; I realized the difference, and I realized that it was due to the difference in humus. Then I read a pamphlet by Dr. Harlan on "Farming with Green Manures," and I began to look around me, and saw the farmers growing clover, without putting manure on the soil, and I soon found that soil to be more productive than other soils. Then I learned that the clover made the soil rich, made it darker and raised the temperature of the soil, putting in it the moisture and the humus, and the plant food that is so deficient in the old soils of our country. There is no pleasure in farming a poor soil. I have always been a humus crank, and am growing worse and worse from year to year. It seems to be a hopeless case. Probably the best I can do in my limited time, is to tell you of some of my work. I feel there that I am standing on solid ground.

I grow a general line of orchard crops—strawberries, cherries, currants, apples, pears, peaches, and plums, and I grow some of the ordinary farm crops, mostly as a feeder to my orchard. I also grow a great many small fruits and vegetables. We have been growing berries quite extensively. We find that we can keep a clean and healthy tree by cultivating the small fruits under it until the tree gets nearly to the bearing age. I have thousands of strawberries and currants growing in my orchards, and I find this a very satisfactory and profitable method.

The first thing is to get an orchard site that is free from frost damage. We want frost drainage. I am about twenty miles south of Lake Erie; then we have, again, the Valley of the Maumee River, which is thirty or forty feet lower than my farm, and these things seem to give us protection to a large extent, against the frost; in fact, we have been very free from frost, having but one severe loss from frost in the last twenty-three years.

Having selected the ground, the next step is to see that it is well underdrained. In my own case, we lay tiles three or four feet deep and 80 to 100 feet apart. Some people claim that good fruit soil should be naturally drained, but I have found the tile drainage to work very well in my peach orchards.

I like to start an orchard by using a hoed crop first. I put in a hoed crop, and then plant the orchard. I have been doing a good deal of fall planting, mostly apple, pear and plum; we are usually so busy in the spring that it is hard to get our tree planting done. Until lately, we have not been doing much with the one year old trees. My preference has been to get a two-year-old tree. Most of my orchards are planted twenty feet apart each way on the filler system, for which purpose I have used apples. I have a great many early varieties, and I prefer to use them in part. Some growers have been very successful with peaches, as a filler, but I have preferred not to mix my varieties, and have used the apples, chiefly of the early bearing varieties, such as the Yellow Transparent, Oldenburgh, Jonathan or Rome Beauty, all of which do very well with us. You can hasten the bearing of these filler trees by proper methods. In the case of the apple, I like fall planting, and in spring planting I want to get them in just as early as possible after the ground is ready. After I have planted the tree in the fall, I top work it the following spring. I prefer the Northern Spy for a stock and have used the Ben Davis. I always like to cut the scions in the early winter and keep them as nearly as possible in a dormant condition; in short, just as with anything else, don't let them get too wet or too dry. Then after the trees get well started, and the buds come out, we do our grafting, and we get better results by working this way. The general practice is to wait a year before doing any grafting, but I am satisfied that you lose time by it.

We start about 20 inches from the ground, and use a single scion. We have off one corner in putting in the scion, and we get a good deal better results in healing over in this way.

Now, I have practiced it for fifteen years, and while I have no data to show that I have secured any better fruit by selection, I believe that I have gotton better results than if I had not practiced it. There are several things that go toward producing early bearing, but I believe this top working is one of them.

In the matter of pruning, my maximum is that pruning is a necessary evil. It is impossible to get a tree that does not require any pruning, but every limb that is cut off takes that much from the tree. I head my trees about 20 inches from the ground; the Rhode Island Greening we do start out a little higher, but our principle is to keep the trees down as low as possible, because with the present day implements, one can cultivate close enough. It may look a little better to cultivate to within an inch or two of the tree, but in a year or two it does not matter, and you are avoiding a large, high tree.

Then we plant in the orchard, potatoes or currants or strawberries. There are some objections to strawberries; the first year it is all right, but the second year they rob the orchard of some moisture. We seldom pick our strawberries over one year, and the latter part of June, the apple orchard is ready for cultivation.

The first four or five years we grow vegetables or small fruits. We take them out when the tree gets into bearing, and then we plow up the ground and grow cover crops. It is not safe to have any hard and fast rule; a good general must be able to change his plans over night. We use soy beans, or perhaps cow peas would do as well, but we use the soy beans, because we can cultivate by team, and they add humus to the soil. I know of some growers who allow the hogs to go into the orchard and gather up the soy beans, but my own practice has been to let the beans go to the ground, and turn them in. Then, I like crimson clover. We have one orchard, about eight years old, just coming into bearing; we got about a bushel per tree this last season. In this we have grown clover, leaving it mulched around the trees, and then the following spring, turned it in again. Another cover crop that we use very largely is the sand vetch. One objection to it is that its growth takes place in the spring, and thus prevents cultivation, and takes up the moisture that is required by the tree. The vetch, however, seems to take up an immense amount of moisture and retain it in the soil. It is better in this respect than the rye. Mr. Powell recommended crimson clover, but it is not so hardy with us as vetch. We find in cases where the vetch had been planted that we secured twenty bushels more potatoes than where we had grown clover. We like to sow the vetch in July, to get the best results, although we have sown it as late as September, and still had good results. It lays quite low on the ground, and is very convenient to work around because it is not high, and it makes a wonderful growth.

Now, after the young tree has been shaped, we try to do just as little pruning as possible. I think we often delay the bearing time of our young orchards many years by unnecessary pruning of the horizontal limbs. I know, in my own young orchard, years ago, I explained to my foreman what I wanted done, and he said it didn't look right to him. I gave him permission to do as he thought best, but on my side, I carried out my theory, and in a few years, we saw the good results of it. We will have to be a little more sparing in our use of the knife. We will have to learn from our wiser friends. We are just in the kindergarten stage of fruit growing. A few years ago when the Western men began to ship in this fine fruit, and our orchards were attacked by the San José Scale, we became discouraged, but we find that we can grow just as fine fruit as they do in the West, and the Good Books says that "God gave man dominion," and that must include the San José Scale and everything else. In fact, it has been the best blessing we have had. It has been a little hard on the small grower, but it has put thousands of dollars in the pockets of the commercial grower. Let us spray more freely, and we will not have to do so much pruning. Of course, that does not apply to the peach trees, which needs more pruning. The apple, the pear and the plum need very little thinning. Many have said that the sour cherry needs but little thinning, but I find it needs about the same as the apple does. We do our pruning in the fall, winter or spring, any time after the leaves fall off.

In the manner of cultivation, we believe in early cultivation in the early life of the tree. In the second stage—the orchard may be divided into three distinct stages—it is when we grow cover crops

we are growing fertility right there in the orchard, and the third stage, when the trees begin to occupy the ground completely, we depend on hauling in all the vegetable matter we can get—leaves, and straw, and manure or anything that will rot and become vegetable matter.

In regard to spraying, I hesitate a little to give you my methods of spraying, but I do so, to show you what can be done under favorable conditions. We have only been spraying twice a year. Perhaps you will say we don't get results, but as a statement of what we get, at the last Ohio show, the best we have had in Ohio, with a carload and a half of fruit on exhibition, we got thirty-nine prizes, thirty-six first and three second, out of forty-three exhibits. That was secured by spraying twice. Now, don't go home and do this, and lose your fruit, and then say I advised you to do so. We have been spraying for the past twenty-five years. We spray once, just before the blossoms come, with lime and sulphur, and then once when the blossoms fall. We reach the tree from four or five different sides. We never consider a tree sprayed until it is sprayed from both sides, with the wind blowing that way, and we do thorough work. The Experiment Station did some thinning in my orchard, and Prof. Green said there was less than one-half of one per cent. of sprayed fruit that showed any signs of any disease or worms. That was not because of two sprayings alone but because we have been spraying for twenty-five years. In the southern part of the state they have Bitter Rot and must spray more, but we have not had any trouble with it in our part of the state.

The next thing I want to talk about is thinning. It is impossible to grow a high grade of fruit without thinning. You will have nubbins. Suppose you have a tree bearing a thousand apples; is it more work to pick five hundred apples in July and five hundred in October than to pick them all at one time? That tree will be in better shape and you will get a better price for your fruit by the two pickings.

When my orchards were beginning to come into bearing, I began to look around among the commission men. One of them told me he had bought fruit in one year from a hundred and ten orchards, paying an average price of $1.00 per barrel, but by the time the storage, the freight, and the commission, etc. were added, those apples must retail in winter to the consumer at $1.00 per bushel. The result was that when I started in the business, I put up my own storage house. Then I went to the leading grocers of the nearby towns and showed them my samples. Now I make it a point to have something a little better than the Ben Davis to offer I have never used the Ben Davis apple in my life, until last year I planted a thousand of them and top-worked them. We arranged that I was to ship these apples on telephone orders, and then I said "we had better speak about the price." He said "you set your own price, and I will add a little profit to it for myself, and that will make the selling price." I have always set the price on everything that has gone out of my orchards. You want to be sure not to rob your customer the first time, and then he will come back. I have people come twenty and thirty miles in their automobiles to buy their fruit direct from the orchard. By dealing direct with the consumer, you can establish a very profitable and desirable class of

trade. Our own home-grown fruit is always to be preferred to the Western fruit. Then, about the other side, why pay a dollar and a half to two and a half a bushel? Apples at a dollar a bushel are high enough to give us a splendid profit, and yet leave the fruit within reach of the average consumer who cannot afford to pay these exhorbitant prices.

I have spoken principally about apple orchards, but many of the methods apply equally well to other fruits. With the cherry, our method is about the same, with the exception that we can start cultivation a little earlier. You hear about cherries and peaches wanting a thin soil. That is all nonsense. They must have a soil that will feed them, just the same as the other fruits. In the peach orchards, we attack the curculio by spraying when the spring comes, and we also spray for the plum rot, and in our orchards they have been practically overcome by spraying.

A YEAR'S WORK IN DEMONSTRATION ORCHARDS

By PROFESSOR H. A. SURFACE, *Economic Zoologist.*

It should be very encouraging to us to see the progress along the lines of horticulture, because of the justifiably high rank that Eastern grown fruits, and especially Pennsylvania fruits, are taking. Tree planting has increased largely all over the State, not only in the commercial line, as shown by that magnificent exhibit over in the hall, but thousands of individual growers all over the State show a high rate of progress in many different counties. You and I know that a few years ago, we had dark days of discouragement. Planting in Pennsylvania was reduced to the lowest possible stage, for the discouragement was justifiable. The orchards in Pennsylvania were being destroyed by the San José scale, and by other pests. It was necessary to do something to eradicate them, and to do it quickly and thoroughly. Many and many a man was tearing out his trees by the roots in the belief that they were hopelessly affected. It was the duty of the Department of Agriculture, through the Bureau of Zoology, to try to overcome this. We commenced publishing bulletins telling the people how to spray. It was good, as far as it went, but it did not go far enough, so we were compelled to go out into the highways and by-ways and compel them to see. There were many persons who were willing to try it on their own responsibility, but many of them were so hopeless and discouraged that they did not even care to try. To overcome this, we had to go out and do the work ourselves, and risk our reputations on the result of the work. And when we did go out, it seemed, as one man said, that we were expected to take the worst and most dilapidated orchards, and make them perfect specimens. You cannot do that any more than you can take an old, kicking bronco and make of him a lady's horse; but where we have had conditions that enabled us to do good work, we have had good results.

We have found that the lime-sulphur solution, and the arsenate of lead, will do all the necessary work, and you know, my friends, what a blessing it will be to horticulture to know without a doubt that the concentrated lime-sulphur and arsenate of lead is all that is necessary for a summer and a winter spray. I think the time is close at hand when we can say that the lime-sulphur and arsenate of lead will control all of the pests for which we have had to spray. This subject comes up later in the afternoon for further discussion, and I shall not further speak of it now.

In a few minutes there will be brought into this room, a map showing where the demonstration work has been carried on. The demand for demonstrations was such that we could not attend to it except in about one case out of a dozen. Then we arranged the Supervision Orchard Plan. We went to the orchard, met the owner, looked at the trees, pruned some and showed him how to make the concentrated lime-sulphur solution and apply it, prescribed treatment for the coming year and then left the work with him, helping him by correspondence as at all times with all persons who request services by correspondence. We find, now, however, that we cannot even get to these supervision orchards without dozens of people coming when they know the demonstrator is going to be there. We find no difficulty in getting an audience now, at any time or anywhere; often they number five or six hundred. I have a letter from a lawyer at Scranton, in which he says that when the demonstrator came there to supervise the spraying of his orchard, the weather was so bad that they only went out and looked the orchard over, and then came back to his greenhouse, where there were sixteen persons gathered to take instruction.

We find this getting into personal contact with the grower and showing him his needs, and the needs of each individual tree in his orchard—for each tree has an individuality of its own, just as every cow, or horse, or man has—is the best means of obtaining good results. It is hardly worth while for me to stand before you and tell you what results we are having, or *you* are having, because you are the people who get the results. I can point you to a dozen people in this audience who are getting better results this year, by these methods, than they ever saw before, on the same trees, but our cry is not so much "more fruit" as "better fruit."

The rush for tree planting has already passed beyond the experimental stage. One of our largest nurserymen told me recently that he had sold more nursery stock in Pennsylvania the past year than in any other state in the Union, and is seems to be the opinion of our nurserymen that this tree planting is increasing very rapidly. You ask, "what will be the result?" It will be a great deal of very good fruit, and a great deal of very poor fruit. There are still many people who imagine they can start an orchard, buy a tree and put it in the ground, leave it there without attention, and then get good results. Any man who does this will fail. He must be there on the spot, and he must know his trees and his subject. If he does not, he will fail, and he had better stop at once, before going into any extensive planting, which would mean greater losses.

In this same building, there is a general agricultural meeting now going on, at which the attendance is about one quarter what it is here. At the same time, stop and compare the profits you re-

ceived from your fruit trees with those of the general farm crops on the rest of your farm. It is scarcely worth my while to give you figures but let me tell you that the attention of America is being turned to Pennsylvania, because of the magnificent fruit our people are growing—as fine as anything the West ever produced. In our fruits we can produce the size and color and we have also the quality, and we save over fifty cents per bushel in freight. I know of three men who are now selling their Western fruit lands to come to Pennsylvania to grow fruit. I have here a letter from a man who has sold his Oregon lands at $2,000 an acre to come here for this purpose. We have all the possibilities of success. We have the climate; we have the soil to grow fruit; it simply takes modern methods to develop it. If the average Eastern man were to go West and attempt to grow fruit in the same slip-shod manner that he does here, he would fail; and on the other hand, if the Western man were to come here with his methods, he would be able to grow more and better fruit, without the expense of shipment. The chief effort of the latter would be directed toward more thorough pest control.

Seeing the danger of these pests, we commenced to spray with the lime-sulphur solution to control them. At first we had to consider it in the light of an experiment, because we did not then know whether it was right. The office of your Economic Zoologist was among the first to advocate it, and what is the result? You have heard it at this meeting. There are orchards in this State that were thoroughly infected with scale, but which are now absolutely free, and producing magnificent fruit. We are receiving letters from Kansas, Iowa, Texas, Virginia and Ohio, inquiring regarding the fruit lands of Pennsylvania, and in most of them they say they have been attracted to this state by our demonstration work. In this, as in other things, the pioneer must necessarily bear the blunt of blazing the trail.

(Map showing location of demonstration orchards shown here.)

In addition to this list of demonstration orchards, we have over eleven hundred farms as supervision orchards. We are gratified to learn of this success. I will call on two or three of my inspectors to take a few minutes of my time to tell you some of the results they find.

Taking some of the counties in order, we find in Adams, at Mr. Lupp's orchard, one year ago we had a few, a very few persons present at the demonstration meeting; this year we have received eighteen different requests from the town of Biglersville alone, asking us to undertake the supervision of their orchards.

Allegheny.—Oakdale Orchard Co., Major Nesbit: Some of these trees were cut back one-third, and Major Nesbit reports that the result last year was certainly fine.

Armstrong.—Rev. Mr. Kerr reports that the work of the demonstrators is serving as an inspiration, and they are waking up to the needs of tree pruning, fertilizing and cultivation. "This work has been of untold assistance to the citizens of Pennsylvania."

Berks.—One of my inspectors received this communication: "You no doubt remember that you conducted a public demonstration in my orchard, and you will perhaps remember how discouraged I was,

and how you tried to encourage me by saying, you can easily save that orchard; if I only had one like it, I would be glad. Well, we have saved it; we have the scale under complete control. One of my neighbors told me I wasted more material than he used, but I told him I would save what he lost."

Here is the fundamental principle for success in spraying: Use the right material freely and strong enough and do thorough work.

A prominent Berks county grower writes us that if it had not been for the demonstration work, his trees would have had to be cut down, but the scale is now under complete control. He adds, "We cannot afford to give up this work."

Only recently I was in Ohio and I saw persons there cut down hundreds of trees because infected with scale. I am glad we are showing the people here how to save them, rather than cut them down.

In Bedford county we have some of the finest fruit in Pennsylvania. At the Pittsburg Land Show, the Jonathan apple grown by Prother Richards, received special attention and first award. His trees were once completely infected, but he sprayed with lime- sulphur, and now has the scale in full control.

From Bradford county I have a communication saying that the results of spraying were very satisfactory. Mr. Fred Bohlayer, of Troy, writes: "I suppose you will want to hear about the work done by the State in our Model Orchard. The results from the work done in the spring are certainly a surprise. While most of the orchards bloomed full in the spring, most of the blossoms dropped off, except those that were sprayed. In this part of the country there are scarcely any apples. In our own orchard, in which you gave the demonstration, I have about six hundred bushels. They are selling here at a dollar. There are scarcely any wormy ones, as I have no trouble with the worms."

We have found that the lime-sulphur is also a preventative of the blister mite, if applied while the trees are dormant.

As you get closer to this map, you will see that the white pins stand for the demonstration orchards, and the black pins for the supervision orchards, and there are one and a half times as many of the latter as of the former.

This letter of Mr. Bohlayer's, from Bradford county, also speaks of spraying the King apple. "The King trees rather looked as if they were going to die last year, but after spraying with the lime-sulphur, there was no trouble; we sent a box of these apples to the Land Show in Pittsburg, and if you are there, would like you to take a look at them."

Cambria County.—We had two demonstration orchards, one of which produced remarkable results, and the other did not. There are cases where the trees need something else besides spraying, something else besides pruning. Soil and climate have much to do with results, and then, again, we must not expect a hundred per cent. the first time we spray.

Center County.—Col. Reynolds sold $20,000 worth of peaches from the orchard in which we gave the demonstration. There were quite a number of students from the College, as well as many other people there to meet my inspectors. In Mr. Brinton's orchard we sprayed one side of a tree; how about that tree?

Delaware County.—I have a letter from a very prominent citizen, at the demonstration in whose orchard I was present. He says "We have learned more about the Yellows than we have ever known, and I hope to profit by it so that I will never again have to take out half of my bearing trees, due to failure to take out a tree that looked healthy. The San Josè scale is now so scarce that it requires a search to find any, except on one tree. The apples are finer this year than last, and in the two years, besides having all the apples we could use and some to give away, we have sold enough to pay for our spraying apparatus and labor. We have good, healthy trees, all due to your advice. Your advice to spray, spray, spray is producing very good fruits, with very good prospects for the future, and for the life of our trees. We thank you. It is good to see the interest in the work that is starting in our neighborhood. The best of it is that every one who sees the results is getting a spray pump and using it."

In fact, we will undertake no demonstration work, or supervision work, until the owner will agree to get spray pump and use it.

Every once in a while I receive a letter concerning our inspectors, and their thorough knowledge. From Delaware county comes a report like this: "Your inspector spent the afternoon in my orchard. He is faithful and earnest in his work, and I want to congratulate you on the character of the men you employ."

From Lawrence county I have a newspaper clipping headed "Johnson gets $8,000 for his apple crop, and his brother gets $6,000 for his apple crop." Rev. Mr. Johnson, of Newcastle, writes me that he is getting the best results from spraying, and says "I am delivering 42 bushels of apples per day at $1.10"—making $42.20 a day.

My time is getting short and I can not take time to mention details of results in all the counties, as I had intended, but I wish to say that the report from Lycoming county is to me of special interest and value. The writer, Mr. Wilson, says: "I wish to tell you of the results of spraying and demonstration. I have about 1,000 trees. In 1903 I had about 2,000 bushels of good apples; in 1904, about 1,000. In 1905, a buyer, a gentleman from your city came and looked over my cellar and said, 'I will take your Paradise,' but refused all the others because of the condition they were in. [His crop was running down.] In 1906 and 1907 it was hardly worth the trouble of gathering. [He got down to the discouraged point.] In 1908 it was but little better." In 1909 he purchased a spray pump and commenced to spray under our supervision. The trees were sprayed twice, with Bordeaux and with lime- sulphur, and he writes, "We had 1,500 bushels. Our mistake was in not spraying with arsenate of lead." This year he sprayed with it, and had 1,400 bushels of nice large apples, the finest his orchard has ever produced. "It is not that I want to take any honor in writing this," he writes, "but to express my appreciation to those of you who have been hammering away at us fellows, telling us what to do. A number of people are starting orchards in this and adjoining townships, and we are going to organize a Horticultural Society."

I have not taken the time to prepare a paper; the stress under which I have been working for the past few days is my excuse for this, and I trust you will pardon it.

In conclusion, as the result of this success, all we ask is that you give us your kind and cordial sympathy and co-operation, which we have had heretofore. The work that has been started is necessary for the continuation of your success. We aim to meet the needs of the people, and we invite your friendly criticism. We have the satisfaction of knowing that we have been of public service, and the gratification of receiving in return, the support and expressions of interest of our friends.

LIME SULPHUR SPRAYS FOR THE SUMMER TREATMENT OF ORCHARDS

By W. M. SCOTT and J. W. ROBERTS, *Bureau of Plant Industry, U. S. Department of Agriculture.*

DILUTE LIME SULPHUR SOLUTIONS FOR APPLE DISEASES

The lime-sulphur preparations for the summer spraying of the apple have been developed not because Bordeaux mixture has not proved to be a good fungicide, but because it often injures both fruit and foliage to a very serious extent. On the fruit of many varieties the injuries caused by Bordeaux appear as russeted streaks or areas. Often, too, many of the apples are drawfed or badly distorted. The applications made within three or four weeks after the blossoms fall are largely responsible for these injuries, which are particularly serious in a wet spring.

Midsummer or late spraying, such as that required for bitter rot, seldom russets the fruit since by that time the tissues of the skin have become more mature and are accordingly less tender. The skin of the young fruit is injured by the copper, the injured parts enlarging with the development of the apple and finally forming the familiar russet spots and streaks. In wet seasons russeting of fruit may be so serious as to reduce its market value 25 per cent. or even 50 per cent. in some cases.

Lime-sulphur preparations then, comprise the results of an attempt to find a summer spray of less causticity than Bordeaux mixture but possessing its fungicidal powers. During the past four years the Bureau of Plant Industry, and some of the experiment stations, have been conducting experiments with lime-sulphur fungicides and the results have been such as to warrant the recommendation of a lime-sulphur solution as a partial substitute for Bordeaux mixture.

THE LIME-SULPHUR SPRAYS

The lime-sulphur preparation used for summer spraying is but a weak modification of the old wash, long used as a dormant spray for scale and peach leaf curl. Concentrated lime-sulphur solution may be made at home by boiling lime and sulphur in water, or it may be purchased already made up, requiring then merely dilution to make it ready for use.

Home-made lime-sulphur solution to be used, when diluted, as a summer spray on apples, may be prepared as follows: Boil 16 pounds of sulphur and 8 pounds of lime with 10 gallons of water for about an hour, finishing with 8 gallons of concentrated solution. Then strain and dilute with water to make 200 gallons of spray. In each 50 gallons of spray there are 4 lbs. of sulphur, which according to our experiments is about the right strength for apples during the growing season.

If it seems desirable to make it up in larger quantities 50 pounds of lime and 100 pounds of sulphur may be used with enough water to leave 50 gallons of concentrated solution when the boiling is done. For summer spraying two gallons of this solution at this strength will control apple scab, leaf spot, and cedar rust fully as well as Bordeaux mixture and with injury which is very slight compared to that of Bordeaux.

For specific directions for the preparation of concentrated lime-sulphur at home, your own experiment station's bulletins by Prof. Stewart, contain the latest and best information.

Numerous brands of commercial lime-sulphur for fungicidal and insecticidal uses are now to be found on the market. Most of these test 30 degrees to 33 degrees on the Baume spindle and for summer use on apples are to be used at a strength of 1½ gallons to 50 gallons of water. Such a dilution gives us about 4 pounds of sulphur to each 50 gallons of spray and is equivalent to the home-made solution diluted to the before mentioned summer strength. All of the commercial solutions, which we have used, gave fairly uniform results and compared favorably with the home-made solution. The chief difference between the home-made and commercial preparations seems to be in that while the former is much the cheaper, it is also the more troublesome.

RESULTS OF EXPERIMENTS

Experiments comparing the lime-sulphur preparations with Bordeaux mixture in the treatment of apple diseases have been conducted by the Bureau of Plant Industry in Virginia, Nebraska, Missouri and Arkansas. Excepting bitter rot and blotch, all diseases of the fruit and foliage in all the experiments were as thoroughly controlled by the lime sulphur solution as by the Bordeaux mixture. The lime-sulphur produced very little or no russeting of the fruit and no serious foliage injury while the Bordeaux injured both fruit and foliage of Ben Davis, Jonathan, Yellow Newtown, and some other varieties. The lime-sulphur sprayed fruit was invariably superior in appearance to that sprayed with Bordeaux.

Experiments for the control of apple scab on Winesap were conducted in Virginia during 1909 with the following results. On the plots sprayed with lime-sulphur solution less than one per cent. of the fruit was affected with scab; on that sprayed with Bordeaux mixture about two per cent. of the fruit was affected; and on the check or unsprayed plot thirty per cent. of the fruit was scabby.

During the same year similar experiments were conducted in Michigan with like results. The scab was held down to four per cent. of the crop by the lime-sulphur solution and to three and one-half per cent. by Bordeaux mixture, while eighty per cent. of the unsprayed fruit of the same variety (Wagner) was affected.

Results of experiments conducted in Arkansas by the Department of Agriculture were not favorable to the lime-sulphur solution in the control of bitter rot and apple blotch. These two diseases were checked by the spray but not thoroughly controlled. There is therefore some doubt as to the efficiency of the lime-sulphur solution as a remedy for bitter rot and blotch.

In both the Virginia and the Michigan experiments the commercial lime-sulphur solution at a strength of 2 to 50 slightly scorched the leaves particularly on the terminal shoots, but this did not prove to be serious and at the end of the season the foliage was in good condition, the apple leaf-spot having been controlled and the cedar rust held in check. It was found also that arsenate of lead used with the lime-sulphur solution did not result in injury to fruit or foliage and that it controlled codling moth as thoroughly as when combined with Bordeaux mixture. A full account of these experiments was published in Circular No. 54 of the Bureau of Plant Industry.

EXPERIMENTS OF 1910

During the past season experiments were conducted at Waynesboro, Virginia, on Winesap, York Imperial and Ben Davis. From 75 to 100 trees of each variety were sprayed and a check of about ten trees of each variety was left unsprayed. Each variety was divided into four plots and treated as follows:

Plot 1.—Commercial lime-sulphur solution, 1½ to 50 with 2 pounds arsenate of lead.

Plot 2.—Home-made lime-sulphur solution, 2 pounds of lime and 4 pounds of sulphur to 50 gallons of water, with 2 pounds arsenate of lead.

Plot 3.—Bordeaux mixture, 3 pounds bluestone and 4 pounds lime to 50 gallons water, with 2 pounds arsenate of lead.

Plot 4.—Check, not sprayed.

The Winesaps were sprayed, (1) after the cluster buds opened, just before they bloomed (April 5th); (2) as soon as the petals fell (April 19th); (3) three to four weeks later (May 17th); and (4) nine weeks after the petals fell (June 26th). The Ben Davis and York Imperial received only three treatments, the first application given the Winesaps having been omitted from these varieties, for the reason that in Virginia they do not suffer seriously from attacks of scab.

LIME-SULPHUR SOLUTION AND APPLE SCAB

In order to find the comparative efficiency of the sulphur and copper sprays for the control of apple scab, fruit from four Winesap trees in each plot and six check trees were sorted and the results are given in the following table:

TABLE I.

Lime-Sulphur Solution vs. Bordeaux for Apple Scab

Number of plot	Spray Mixture Used.	Per cent. of scab by fruit
1	Commercial lime-sulphur solution (1½ to 50) plus 2 pounds arsenate of lead,	2.2
2	Home-boiled lime-sulphur solution (2-4-50) plus 2 pounds arsenate of lead,	6.1
3	Bordeaux mixture (3-4-50) plus 2 pounds arsenate of lead,	6.2
4	Check, not sprayed,	99.8

From this table it will be seen that the home-made lime-sulphur solution and the Bordeaux mixture both held the scab down to about six per cent. of the crop, while practically all of the unsprayed fruit was scabby. The plot sprayed with the commercial solution had the lowest percentage of scabby fruit (2.2 per cent.) but this was probably due to a difference in the plots and not in the fungicides. Plot 1 contained medium-sized trees easily sprayed while the trees in plots 2 and 3 were large and rather difficult to spray with the outfit used.

It would appear from these results and those obtained in previous experiments that the efficiency of the lime-sulphur solution as a remedy for apple scalp need be questioned no longer.

EFFECT ON THE FOLIAGE

Directly after the second spraying of the Ben Davis and Yorks, the foliage of these two varieties showed injury to a noticeable extent. This, however, was to be expected as the unusually cold and wet weather of April and May was particularly favorable to spray injury.

On the lime-sulphur plots the leaves of the young shoots were somewhat scorched about the margins, and as a consequence, some of them were curled and distorted. Also on some leaves a few dead spots were to be seen and for a time it looked as though serious injury might ensue. The leaves, however, showed no further injury as the season advanced, even after the next application. By midsummer practically all evidence of injury had disappeared and during the remainder of the season the foliage was in excellent condition. There was no apparent difference between the foliage of trees sprayed with the commercial solution and those sprayed with the home-boiled.

The foliage injury caused by Bordeaux mixture was markedly greater than that caused by the lime-sulphur preparations and differed in that it became worse as the season advanced. The leaves were more or less spotted with circular brown areas and a considerable percentage of them turned yellow and dropped.

The trees sprayed with the lime-sulphur solution went through the season with much better foliage than those sprayed with Bor-

deaux mixture, showing the marked superiority of the former fungicide as a foliage spray.

The apple leaf-spot disease was controlled equally well by both fungicides, but the lime-sulphur solution showed some superiority over Bordeaux in its tendency toward the control of cedar rust, a disease which seems to yield more readily to the sulphur than to the copper sprays.

EFFECT ON THE FRUIT

There was no appreciable difference between the lime-sulphur solution and Bordeaux mixture in the control of the diseases that occurred on the fruit. Apple scab, fruit spot and sooty blotch were controlled equally well by both fungicides. But particularly in the case of the Ben Davis there was a decided difference in the appearance of the fruit sprayed with these two fungicides. The fruit sprayed with Bordeaux was considerably russeted although very little of it was dwarfed or distorted as often occurs with Bordeaux sprayed fruit. The Winesaps were also russeted though not so much so as the Ben Davis, while the Yorks showed only a slight roughening of the skin. The latter variety is almost immune to Bordeaux russet.

In all the varieties sprayed with the lime-sulphur solution the fruit was almost entirely free from spray russet. The natural russet at the stem end was enlarged slightly and on some specimens this ran over on to the side of the apple, but apples which were at all badly russeted were extremely rare. As a rule the fruit was smooth, clean and highly colored: placing it in a grade higher than that sprayed with Bordeaux mixture which would mean twenty-five cents to fifty cents a barrel in price.

ADOPTION OF LIME-SULPHUR IN VIRGINIA

As a result of the experiments conducted in Virginia during 1909 by the Bureau of Plant Industry, practically all of the Virginia apple orchards were sprayed with the lime-sulphur solution during the past season. We personally examined some of these orchards and have had reports from many of them. In every case, so far as we have been able to ascertain, the results were satisfactory, both as to the control of diseases and as to the effect of the spray on fruit and foliage. In the early part of the season there was a number of reports of injury to the young leaves, but in no case did this prove to be serious. In the Yellow Newtown orchards where bitter-rot is a serious factor, the lime-sulphur solution was used in the early treatments for scab and leaf-spot, and this was followed by applications of Bordeaux for bitter-rot. This plan was entirely successful, the russeting of the fruit having been avoided and the bitter rot disease controlled.

CONCLUSIONS AND RECOMMENDATIONS

The evidence obtained from various experiments conducted by the U. S. Department of Agriculture, and several of the experiment stations seems to warrant the following conclusions:

Bordeaux mixture often russets the fruit and injures the foliage of many varieties of apples and its use in the early part of the season should, therefore, be avoided as much as possible.

Lime-suphur solution, diluted so as to contain four pounds of sulphur in each fifty gallons of spray, is a good substitute for Bordeaux mixture in the treatment of apple scab and some other diseases, and will not materially russet the fruit nor injure the foliage. The concentrated solution may be purchased from the factory and diluted at the rate of 1½ gallons to 50 gallons of water, or it may be prepared at home.

This fungicide will control apple scab, fruit spot, leaf-spot, and cedar rust, fully as well as Bordeaux mixture, but has not as yet proved to be as satisfactory for bitter rot. Where it is necessary to spray for this disease, the early lime-sulphur applications for scab may be followed at the proper time with Bordeaux for bitter rot, thus avoiding the russet and yet controlling the rot. There is also some doubt about the efficiency of lime-sulphur in controlling apple blotch and where this disease is bad Bordeaux should be used.

Arsenate of lead may be safely and successfully used in combination with the dilute lime-sulphur solution for the control of the codling moth and other insects.

The course of treatment best suited to orchards in Pennsylvania and adjacent districts may be outlined as follows:

Use the commercial lime-sulphur at a strength of 1½ gallons to 50 gallons of water, or an equivalent strength of the home-made preparation, with the addition of 2 lbs. of arsenate of lead in each 50 gallons of spray. Spray the varieties subject to apple scab: (1) as soon as the buds have opened, just before blooming; (2) as soon as the petals fall, beginning when they are two-thirds off; (3) three to four weeks later; and (4) nine to ten weeks after the petals have been shed. The first application of this outline may be omitted from varieties that are not subject to serious scab infections.

Where it is necessary to spray for bitter rot the first three applications of Bordeaux mixture at intervals of two weeks, beginning about June 25th to July 1st.

In mild cases of apple blotch the lime-sulphur treatment would probably be sufficient; but in severe cases two or three applications of Bordeaux will be required; the first to take the place of the third in the above outline and the others to follow at intervals of two weeks.

SELF-BOILED LIME-SULPHUR MIXTURES FOR PEACH DISEASES

Owing to the susceptibility of peach foliage to injury by applications of fungicides, the peach grower has been practically powerless to combat the diseases affecting the fruit and foliage. The use of Bordeaux mixture has been frequently attempted and in some cases, especially in dry seasons, the results have been satisfactory, but as a rule the injury produced by this and other copper fungicides is so great as to prohibit their use on the peach.

The efforts of the United States Department of Agriculture during the past few years, to develop and perfect a satisfactory fungicide for use on the peach during the growing season, have been crowned with unusual success. We have found that a preparation known

as the self-boiled lime-sulphur mixture can be safely and successfully used on the peach for the control of brown rot and scab or black-spot. The mixture when properly applied, controls these diseases almost completely and does not injure the fruit or foliage.

The experiments have been conducted in Georgia, Virginia, West Virginia, Arkansas, Missouri and Illinois, and in every case the treatment was successful. During the past year many fruit growers in Georgia, West Virginia, and other sections, sprayed their orchards with the mixture, and so far as it has been tried the treatment appears to have been universally successful in controlling both peach scab and brown rot.

Arsenate of lead may be added to the mixture for the control of curculio, which not only produces wormy fruit, but increases the brown rot infections by puncturing the skin and opening the way for the fungus. The insect occurs in destructive numbers in nearly all eastern peach orchards and in most cases where spraying with the self-boiled lime-sulphur for scab and brown rot is done, arsenate of lead should be added.

PREPARATION OF THE MIXTURE

To prepare self-boiled lime-sulphur, use 8 pounds of resh stone lime and 8 pounds of sulphur to each 50 gallons of water. In order to get good action from the lime the mixture should be prepared in rather large quantities, say enough for at least 200 gallons at a time, making the formula 32-32-200. Place the lime in a barrel or tub and pour on enough water to almost cover it, then all the sulphur. Stir thoroughly while the lime is slaking and add more water if necessary to make a creamy paste. Slaking of the lime and the stirring will make a good mechanical mixture of the sulphur and the lime, only a small percentage of the former going into the solution. As soon as the lime is thoroughly slaked more water should be added to stop further chemical action, as there is some danger of dissolving enough sulphur to injure peach foliage. The mixture is then ready to be strained and diluted for spraying.

OUTLINE OF TREATMENT

For the treatment of peach brown rot and scab, in Pennsylvania and adjacent territory, the following is recommended: Spray the early varieties, like Carman, Hiley, and Champion, about a month after the petals fall and a month or six weeks before the fruit ripens. Later varieties, as the Elberta, Smock, Salway, and Bilyou, will usually require three applications for the best results; the first to be made a month after the petals fall, the second, three to four weeks later, and the third, a month to six weeks before the fruit ripens.

For the curculio, arsenate of lead at the rate of 2 pounds to each 50 gallons of self-boiled lime-sulphur should be used in the first application of arsenate of lead, 2 pounds to 50 gallons of water, with 2 or 3 pounds of lime ,to be made a few days after the petals fall, is recommended, but is probably not often necessary in this section.

PLUMS

By J. W. KERR, *Denton, Maryland.*

First: Can plums be grown in a commercial way in this state, with reasonable assurance of fair profit?

Second: If so, what as to adaptability of soils?

Third: Are there any special cultural operations, indispensable to the realization of the golden hopes of the planter?

Fourth: How decrease the errors, common in the selection of varieties?

Suppose a plat anywhere east of the Mississippi river, one hundred miles square, had a plum specialist at each single angle to solve these queries by the requirements of modern orchard management; as far as general principles would aid the answers would be branded with a similarity, suspicious because of the monotony. If the square is reduced to one-hundredth of this size, with an enthusiastic orchardist at each corner a comparison as to *details* would disclose a variety, rivaling that in the recorded and publicly expressed opinions of the Ben Davis apple.

The accomplishing of the absorbing and vital end, compels the utilization of means, unlike in kind and character, in the prompt control of emergencies, quite frequently and unexpectedly thrust upon the person in charge. No doubtful logic—no inconsistent hypotheses—no fragile assumption need be employed in making affirmative answer to query, No. 1. A far better, stronger and clearer proof than is possible by such means is the tangible fact that in every county in this great commonwealth, plums are grown in a limited way, and in some instances by primitive means, for family use; this is common knowledge, and practically indicative as to the possibilities possessed by this fruit for market growing, as also reliably exemplifying the esteem in which it is held by the people.

The greatest plum puzzle I have seen, hails from a county in this state, where only slight and crude attention is given the plum, outside of what is necessary to provide sufficient fruit for family use, yet from this wholly unexpected source, where for years it has been the main dependence for such purpose, we have a variety, upon the botanical status of which the best authorities do not agree. Up to the present it remains a what-is-it, as relates to species. This digression is made simply to emphasize the important truth, that when plums are discussed from the stand point of a prescribed area, the merits of the fruit as a whole are generally underestimated. Now, if here and there on the farms and about the homes of the people in the different counties, this fruit grows well enough to afford a supply to such families, where in most instances the only attention given the trees is to gather the fruit from them, at all other seasons treated with cruel unconcern and superlative neglect; by what men-

tal process will any other rational conclusion appear in the lime light of common sense, other than that for market purposes, the plum can be successfully grown in almost every county in this state, regardless of the variability of concomitant circumstances, as relates to soil and atmosphere? Comparatively, plums are little if any more perishable as a market commodity than peaches, though the general family consumption is more restricted, which is but a natural result of circumstances. That all of our smaller cities and larger towns offer profitable markets for much larger quantities of the fruit, than are now supplied, is neither fanaticism or sophistry, but an every day fact. Referring to the second query, soils as relates to their adaptation for especially desired purposes, are largely controllable by and amendable to intelligent ambition and the demands of necessity; for in many instances fine fruits are produced now, on soils which but a score of years back, a seriously expressed intention of their utilization for such purposes would have been ruled out by the admonition of prudence and the promptings of sound judgment; because of the apparent violation of the accepted teachings of nature. Nature itself, however, is not infallible. It is none the less a fact, that the nauseating stench of the sweat-shops stamps its deathly pallor on their inmates with no more certainty, than do the untreated and neglected conditions of unsuitable soils on tree and plant life. The exercising of good horse sense would promptly find a remedy in either case, the best soils in an agricultural sense are largely artificial, the degree of fertility and adaptiveness to profitable production in special lines, simply portrays in a broad sense, the intelligence and business qualities of the owner. Not every one distinguished by the honorable title of farmer, is an expert in soil renovation and improvement; neither is every one who plants an orchard expert in soil analysis. The common school of nature does in such cases accurately and distinctly blaze the trail for willing eyes to follow to needed improvement. Generous addition and discreet subtraction will with mathematical precision provide a balanced ration for the soil, and thus assure to it, both ability and inclination for liberal and kindly response to the wishes of its quarter master, who happily treading in wisdom's ways, has learned that tillage is more closely akin to irrigation than to manure, and that effective drainage is a "plumb" necessity.

Query number three if technically construed might imply that some special or unusual process, different in mode and measure from culture given to other fruits is essential with the plum, but the experience every where of successful growers thoroughly establishes the opposite; the practical sanity of profitable plum growing, while tolerant and forbearing, discloses a somewhat unyielding conviction, favorable to frequent surface stirring with such implements as are adapted to the character of the land. That is to say, often enough to protect it against waste either by useless weed growth or in moisture. The means employed to prevent the one, promotes the other. Present day fruit growing operations of the commercial class are notable for deeply interested vigilance and searching economy. Not the kind of economy that restricts needed cultural expenditure, anl loses ten fold in the quality and qauntity of the orchard products; the Book of Books warns against this type of

economy in the parable of the talents. True economy in commercial fruit growing of any kind implies general investment for the needs of the trees, as discerned by kindly watchfulness, confirmed by good judgment and rendered effective by methodical application. No arbitrary code controls, nor ironclad rule regulates in the essential activities of brain and brawn, to forestall unfavorable weather influence; the intuition growing out of personal interest and experience is the surest reliance.

The fourth inquiry invites consideration of features, viewed collectively, are conspicuous in their instability; because of potent local influences, more especially climate and market. Atmospherical extremes as relates to temperature and more pronounced as you recede from large bodies of water; inland situations while shorn of such ameliorating and softening influences in temperature, on the other hand, by the same conditions are to a larger extent free from excessive humidity—the foster mother of brown rot in the plum. The selection of varieties for a commercial orchard, is much like reading a sign-board that reads differently from different angles. Subsequent to the determination of a selection meeting the climate requirements, is the choosing from such selection, a list strictly in keeping with the demands of the market for which the fruit is intended. The fundamental or primary work in establishing an orchard is not a whit less important than in other business enterprises, and is more safely executed under the directions of the trinity of when, why and what, than that of heard, haste and hope. However profound the pomological knowledge of the planter—practical and thorough may be his judgment as to soil—suitableness of varieties as to climate and peculiarities of market, it very rarely occurs that a majority of the varieties found in his first orchard will be found in the second; actual test exposes in the most impressive manner a weakness or short coming in some particular that he fails to remedy. Experience of this kind in one or two instances does not conclusively establish that varieties thus condemned and barred by one planter are unprofitable under the managements of others.

Epitomised—the entire question as relates to profit, soil, culture, market, and varieties is largely under the effective control of one lever, the man.

In a review of the several species, or groups of plums as our authorities have classified them, for the purpose of selecting varieties most promising for a commercial orchard, it is wholly useless to include the Nigra group. Not because of any question as to hardiness of trees in withstanding low temperatures, but the thick, leathery skin of the fruit makes it undesirable in our markets. The same situation exists, to a great extent with the Americana group, though it contains a long list of varieties. For the west and northwest this group affords much greater assurance of crop production than any other, but with the exception of a very few varieties the fruit is met acceptable with Eastern consumers.

One of the most notable exceptions to this thick skinned feature is found in the variety named Hanson, which is the earliest in season of the kinds constituting this large group. The Stoddard is another variety which shows less of the politician in its skin than the average, and possesses that captivating merit of large size.

There are quite a good many other kinds belonging to this group, that produce fruit of a large size, but in markets where buyers can choose, the plums with thinner skins are preferred.

The Miner group is somewhat of a pleasing modification of the Americanas as pertains to the skin, but is deficient to the same degree in the color of the fruit; and on this account is rather unattractive in the package. None of the varieties of this group are early in season. The "Domestica" group which embraces about all the old time garden plums including the Damson, Prune and Gage, shows in its better varieties that much greater effort has been given to its improvement, than is evidenced by any of the native groups. It is still regretably patent that to make a selection of the Domesticas, for commercial orchard purposes, would be a very uncertain and lottery like transaction; though in several counties in this state, splendid fruit is occasionally produced from such varieties as Lincoln, Pond, etc. The Richmond—a Berks county production, while not so large has vigor and productiveness of tree that gives it favor in some localities. Lombard is perhaps planted over a wider area than any other variety of this time honored group; it seems to adapt itself to varied localities more satisfactorily than most of the Domesticas. In quality it is quite variable—poor at all times, but worse some seasons than others. Generally this group offers no specially inviting promises to him who would grow plums for market. The care and skill necessary to grow the finer kinds make them too expensive to favorably compete with the attractive products of the Pacific coast. The many varieties of this group that were imported from Russia some years back, signally failed to fulfill the high hopes that many plum specialists entertained for them. They are rarely catalogued now by tree propagators.

The Triflora or Japanese group has assisted very materially in creating a more general interest in this beautiful and wholesome fruit. Fortunately the earliest importations of these contained one of the best varieties of the species—the Abundance. This variety deservedly holds first place in public esteem. Good color, size and quality, with a free growing, healthy handsome and productive tree; it is well equipped for the market orchard. The Chabot ripening two or three weeks later is another variety that has won favor with growers; while the fruit of this is in all respects equal to the Burbank, there is no comparison in the trees; the Chabot with is fine, vigorous upright habit in growth, while the limit is overleaped is slovenly, dowdy habit by the Burbank. The Red June another pure Japanses variety proves profitable for markets not too exacting as to quality; its early season and brilliant color usually secure profitable sale for it; the tree is a good grower, of good form, but comparatively short-lived. These constitute the cream of this group and are about all that are worthy of much thought as commercial kinds.

Amongst the "Hybrids" there are a *few* profitable market sorts; the most promising one is the Sixweeks, a Texas product and clearly the earliest in season of any plum, worthy of attention by market growers. A rapid growing tree, forming a rather close head, that is regular in contour; an abundant bearer of bright colored fruit of full medium size; rather deficient in quality, but attractive to buyers, owing to its very early season and bright red coloring.

America is the only one of the many kinds from the Pacific coast that is sufficiently resistant to brown rot, to hold out a reasonable hope of fair profit as a market plum.

Gonzales, from Texas is superb in size and appearance, good enough in quality but not sufficiently resistant to Monilia or brown rot to warrant unqualified endorsement.

The Wayland group embraces some varieties that should be profitable to grow in most, if not *all* the counties of this state; the good citizens of which are generally graduates in gastronomy, and never dishonor their diplomas. Your tradition not only perpetuates; but promotes a liberal domestic provision of sweetmeats and table condiments, and this group of plums is unequalled in possibilities in that relation.

For preserving it is unexcelled; and for fruit butter (under the dexterous manipulation of the tactful kitchen queen) it affords a relish, unapproached in its appetizing fascination; for spicing these plums are in every particular, the peer of the best Damson. The trees, too, are not only pleasing to the eye, but distinctly and reliably productive. The Benson is a Nebraska variety, with fruit as large as any of the group, bright cherry red, handsome, and a little earlier in season that the other choice varieties of the group. Tree a very rapid grower with fine healthy foliage. Reed, a trifle later in ripening, but otherwise similar to Benson. The tree of this variety is notably pretty, clothed in showy, large, healthy, foliage; robust and stock in growth. Wayland, still later in season and every way fine. While there are other good varieties in this group, this trio may safely be classed as the select. This class of plums are free from leaf-blight and black-knot—almost immune to injury by the curculio and brown rot and when well ripened are very acceptable for eating out of hand. Why not grow them for the markets?

The Wildgoose group has in many localities established its value for commercial planters, and at this day requires no certification of merit in its discussion, farther than an expression of preference as to varieties. Briefly stated—the Milton for early, followed by Wildgoose and Whitaker and finished up with the Mrs. Cleveland, give the planter the most profitable varieties of the group, for a commercial orchard, all of these kinds are very productive when properly pollinated.

It is a generally known fact that the kinds named in this group, whether planted separately or together will prove unsatisfactory in bearing. Yet the Simley, classed in this group—interspersed in such planting supplies at the right period effective pollen.

The Chicasaw group offers nothing to large, or market growers that would warrant their use in anyway, except as pollinators. For nearby or local markets, the Munson possesses merit; more on account of its size and early season that is quality. It is too soft for distant market. Newman is quite a productive variety and some seasons attains size large enough, but it keeps the grower guessing as to when he will finish picking them, as its fruit ripens over a long period. These two varieties are both, thoroughly reliable as effective pollinators for the Wildgoose type.

The several other species or groups contain nothing claiming attention in this paper. In conclusion, the likes, dislikes and predilection of the planter, will in a large measure determine the group best suited for him; and after settling upon such choice, varieties to fit the market he aims to supply, can be chosen with a minimum of uncertainty.

PENNSYLVANIA APPLE SOILS

By PROF. H. J. WILDER, *Bureau of Soils, Washington, D. C.*

There are many localities in the State of Pennsylvania that are well adapted to apple growing, and it is to the leading growers of such localities that the State owes the existence of this organization. Now, those sections of the State already developed are fairly well known, and it is my purpose at this time to invite your attention to such portions as have not been so well developed. I will say right here, however, that we would not have to go very many miles from where we are now to find plenty of undeveloped fruit soil as good as any already planted, that may still be had at very reasonbale prices.

Nine years ago your President prepared a bulletin for the State Department of Agriculture on "Varieties of Fruits That May be Successfully Grown in the State of Pennsylvania," and I may take occasion at this time to call your attention to the particular excellence of that work in serving the horticultural interests of Pennsylvania.

I will ask you to start with me on an imaginary trip from here to Northeastern Pennsylvania. The map on the wall has been prepared to show some of the principal soil boundaries. The yellow color represents the South Mountain range. The Blue Mountain, or North Mountain, is here shown by the blue belt extending from near Belvidere on the Delaware River southwest to the Maryland line.

South Mountain and its adjacent slopes are well adapted to fruit growing, as most of you know. Pennsylvania owes, in fact, a great deal of her fruit growing reputation to that region, and I may add that it is truly astonishing that the prices of good fruit lands in this state are so low as they are, even in the South Mountain region.

Just east of the Allegheny Mountain, or the Allegheny Front as is is often called, is outlined the "Appalachian Mountains and Valleys Region" which extends in cross-section southeastward from the Allegheny Front to Blue Mountains, and lengthwise from the Delaware River southwest to the state of Maryland. Its width in Maryland is practically the distance between Cumberland and Hagerstown, the latter town being in the limestone valley just to the east. Along the Delaware River the same broad belt extends from near the Water Gap to the northeast corner of the State. This sec-

tion is a part of the great Appalachian Mountain System which becomes much higher in elevation in the Southern states. The region consists of a series of elevations and narrow valleys just like this (holding up fingers). Now, the slopes of these hills are adapted, in some cases, to profitable orchard planting, though on the other hand, many of these hills are not very productive. There are three distinct classes of soils to be found there: First are those soils derived from yellow and brown shales and sandstones which are called the DelKalb soils; second the Upshur soils which come from red shale and thin-bedded sandstones of the same color; and lastly the Hagerstown, or limestone, soils which occur in some of the valleys. In this section of the State there are many suitable locations for orchard planting, but they should be selected with care as to character of the soil, and to the air and water drainage. The prices for land are so exceedingly moderate that it seems unnecessary for any Pennsylvanian to go out of his own State to grow fruit. The old Juniata peach belt, once famed for its excellent product, is in this region, and although it suffered severely from the ravages of disease it still possesses some good orchards, and is certain to see many apple orchards planted, and at least some peaches, notwithstanding the yellows. Why was this famous peach belt first developed? Simply because some fellow living there once made up his mind to grow fruit, and his efforts were rewarded with some degrees of success. It is only human to think that whatever my neighbor does I too can do, and the result in that locality was that most everybody tried the peach business and it was this fact that led in some measure at least to the great number of failures. The striking illustration which the old Juniata peach belt affords is its contrast to other districts not far from it that are just as well adaped to peach orcharding, yet have never been developed. Land prices are still very low in this whole region. .

Going northeastward to the region around Wilkes-Barre similar topographic conditions are found. I spoke a moment ago of the series of ridges crossing the State from the northeast to southwest. This green line (pointing) was put there to indicate the southern extension of the glacier which is supposed to have come down from the North spreading over the hills and valleys to this line. The soil and rock debris left by the glacier gives rise to the Volusia series of soils. Where the layer is so very thin that it has been of less influence in forming the present soils than the original materials over which it passed, the soils have separated and mapped as the Warren series; and again, where underlaying red shale was ground up so fine by glacial action, or where the glacier left an overdeposit of red soils deep enough to determine the character of the surface materials, the Lackawanna soil series was mapped, being named for Lackawanna county where it was first found.

In northwest Pennsylvania other areas of the Warren soils occur in Crawford and Warren counties, in fact the series name was taken from that of the latter county. Northeastern Pennsylvania, it seems to me, possesses wonderfully good opportunities for orcharding at the present time. I was deeply interested in finding how cheap good orchard land can be purchased in that section of the state. Thirty, forty, fifty dollars an acre, and sometimes even

less than that, will buy excellent orchard land in that region within a few miles—frequently not more than ten, and very often not more than five—of the Wyoming Valley markets, which are among the best in the United States. You all know that the coal town markets, whether located in the anthracite or the soft coal regions, are wonderfully good. And even if the commercial orchards should be developed to such extent that these local markets could not take all their products, they are within a short distance from New York and other eastern cities with an aggregate population of many millions of people. This is where the winter varieties can be grown to market advantage. The Northern Spy, Bellflower, Baldwin, Stark, Rhode Island Greening and many other excellent varieties can be grown profitably in this region. I will not take the time to enumerate many varieties, but the Northern Spy interplanted with Wagoner, which also does remarkably well there makes a very effective combination. There are men from that section attending the meetings here this week who own orchards that the Wagener has paid for by the time the Northern Spy came into bearing. One other advantage that district has in growing the Northern Spy is that it comes into bearing sooner after planting than in most sections of New York, in fact it will average to bear in the Wyoming Valley region three years earlier than in Connecticut or New York. Now, this is a remarkable advantage which the state possesses, and there is perhaps no apple of finer quality than Northern Spy when well grown. Besides the Wagener there are other early bearing sorts that have given excellent results as fillers, especially the Wealthy and Oldenburg.

I want to say just here—though it is somewhat of a break in the subject—that at the Lancaster meeting a few years ago I said that the Baldwin and Spy would not do their best on the same kind of soil, that a light soil brought the best results with the former variety and that a soil somewhat heavier was preferable for the Spy. Some one attending got the idea from what I said that neither of these varieties could be grown with any degree of success on any other kind of soil than the ideal described. Now, I hope I did not present the subject in quite so obscure a manner as that, in fact I am sure the records do not so state, but if anyone else did get that idea from anything I said I want to correct it. My idea is that within a given set of climatic conditions there is an ideal in soils for certain varieties and that in orchard planting we should aim to select those soils that come nearest the ideal conditions for the different varieties. If the best possible soil for each variety is not available the trees should be planted on the soil that comes nearest the ideal, and one should always work with that end in view.

In the central northern part of the State (indicating on the map the following counties: Warren, Forest, McKean, Elk, Cameron, Venango, and northern Clearfield, Jefferson and Clarion) the conditions are quite different. The altitude is high—say 1,600 to 2,200 feet, or possibly 2,500 feet—and the soils are quite different. The region has not been glaciated at all, and the sandy types of mountain soils predominate. The district is not generally so well adapted to orcharding as some others, though good soil locations may readily be found. There is a good deal of waste land, but the prices

are such that one can afford to have some waste land—from $3.00 an acre up. Well improved land including buildings may be had at $30 to $40 an acre.

In the southwestern part of the State we have three series of industry has been developed, and here in Mercer, Lawrence, Crawford and southern Erie counties the glacier has passed, forming another important area of Volusia soils where orchards can be grown successfully. Land prices are slightly higher than in the last district described but still they are only forty to fifty dollars an acre, with sixty dollars for very good improved land with good buildings. Just to the south are excellent markets, although not so remarkable as the coal markets of the northeastern part of the State. In many localities within this region there are splendid opportunities to grow special crops. One of the cases I have in mind is that of a young man from one of these towns who came to me up at State College the other day and said he wanted to grow fruit. His father is a fruit dealer but he said, "I don't believe I am worth as much to the business in town as I am on a farm not far distant which my father owns, and I would rather develop the farm. Similar cases are not infrequent at the present time. Near Pittsburg special crops can be grown to advantage for that market.

In the southwestern part of the State we have three series of soils: The DeKalb, previously mentioned; the Brooke series, derived from limestones but still very different from the Hagerstown soils that come from the limestone of southeast and central Pennsylvania; and the Westmoreland soils which come from a mixture of shale and limestone, making very good soils. If it were not for the injury from coke smoke these should be very productive soils.

Now, I have gone over this map upon which are indicated only the broad divisions of soils very hurriedly and will not take any more time in a general description of soil conditions unless there are some questions. Considering the present prices of land and soil conditions, there are three forms of orcharding that may well be developed with profit. First, the commercial orchard—and there are two ways to work along this line,—one, by the extensive method, and the other by the intensive. The goal of the first is to produce a large number of carloads, but with the other the quality of the fruit is the first desideratum, the quality the second. The first means more acres, the other more salable fruit per acre. I believe the most profitable type of commercial development is a combination of these two forms. One may hardly plant too large an acreage until the point is reached where excellent care is sacrificed in some measure, owing to the large extent of the orchards. This will vary much with circumstances, but I believe it is very easy for a man to plant so large an acreage that he is compelled to neglect some of the finer points of the business, even from the strictly commercial viewpoint; and there is a question as to where this point comes—where the individual acreage should stop. In planting, the character of the market must be taken into consideration, and those who adopt Mr. Farnsworth's idea of growing for a special market must include varieties that ripen during a long season, from early to late. This particular method of intensive growing is coming to have more and more influence on orchard development.

RECENT ADVANCES IN OUR KNOWLEDGE OF LIME-SULPHUR

By J. P. STEWART, *Experimental Horticulture, State College, Pa.*

Owing to the increasing interest in the subject, I have been asked again to run over the details of making concentrated lime-sulphur. Details are hard to remember, however, and since they are already available for the asking in our Bulletin 99, it has seemed to me wiser to deal here with some of the more general phases of the subject, presenting rather the principles upon which the details depend. In doing this, it has seemed best to trace out the development somewhat along historical lines, adding briefly in their proper places those features of most importance that we have learned during the past year.

As we have noted before, the career of lime-sulphur as a spray material has been rather checkered. Starting in 1886 at Fresno, Cal., when a Mr. Dusey borrowed a pail full of sheep dip from his neighbor, Covell, thinking that if it killed the lice on sheep it ought also to do it on trees, it speedily became the leading contact insecticide throughout the Pacific Coast. It was then brought East in 1894, soon after the discovery of scale in Virginia, was tried in Maryland, and discarded, being found apparently useless under eastern conditions. It was partially revived by Marlatt in 1900, but failed to secure wide acceptance until after the work of Forbes and others in 1902. From the latter date until approximately 1909, it remained the standard insecticide throughout the country, in spite of its many objectionable and disagreeable features. This was the old, home-boiled, dilute mixture which finally came to be made by using 15 or 20 pounds of lime and 15 pounds of sulphur to 50 gallons of total product.

While this development was taking place in the dilute mixture, another preparation, without the objectionable features, was gradually coming to the front. This was the so-called commercial or factory-boiled lime-sulphur. It was storable, free from sediment, easily applied, and though much denser than the home-made preparation, it was practically free from crystals. Just when and by whom it was first used as an insecticide, I have been unable to discover. It appears, however, that along in 1902 or 1903, a Stock Food Company of Omaha learned that some of their patrons in Utah were buying a few extra barrels of a concentrated cattle-dip for application to trees. Later inquiries and tests showed the value of this, and from that beginning has developed the present remarkable production of commercial lime-sulphur materials. Both types of lime-sulphur insecticides, therefore, came into use rather accidentally and apparently independently, as the result of a transfer in use from dip preparations.

Along in 1908, when the writer became interested in the situation, the making of these dense, non-crystalizing insecticides was supposed to be accomplished by some difficult, factory process, wholly beyond the capabilities of the orchardist, and consequently worth about three times as much to him as we now know they can be readily made for at home.

At this time it was learned that Cordley in Oregon had made a "stock solution" lime-sulphur. Details of his work were meager, however, and not generally available. There also appeared to be some doubt as to the correct ratio of lime to sulphur, and the proper concentration to be used. For example in the version of his formula given by Parrott, 60-to-125 ratio was advised, while in his own later account, 60-to-110 was used; the latter ratio having appeared in 1906 in a formula used by Thatcher, at one-half the present weights. As to concentration used, it appears that with the large amounts of ingredients only enough water was added at first to make 45 gallons of mixture, while with the smaller amounts the total was brought up to 60 gallons. No further additions of water were indicated in either account to make up for the losses in boiling, which was to be for one hour or more. After boiling and settling, only the clear liquid obtainable above the sediment was drawn off; and in the former case this amount of liquid was diluted to make the final 50 gallons of concentrate. This was again diluted for use, at the rate of 1 to 10 (total), and the sediment was to be re-used in succeeding boilings.

The faults and uncertainties of this method are very evident now; and it was doubtless fortunate for the home-made concentrate that no wide attempt was made to strictly carry it out in orchard practice. It is of interest, however, as marking the advance made up to the early part of 1909.

The next move was made at the Pennsylvania Station. The work had begun before the above accounts appeared, though most of their facts were known. The general attitude and prospects for success at that time may be gathered from a remark by one of our leading insecticidal chemists, then at the Station, whom the writer was trying to enlist in the cause. His advice was to go ahead with the work but not to be disappointed in case nothing was learned, because the whole subject had been studied thoroughly already by chemists, and nothing new was to be expected.

The results of the subsequent work have appeared in various places, and we can here merely mention some of the leading points established. We found that the crystals occurring in the old, dilute preparation were due to excess of lime. The value of this excess was questioned and later proved to be unnecessary against scale, as was already known in the case of fungi. The cause of the crust which develops over concentrates was shown to be due to exposure to air, and its prevention was readily accomplished.

The proper ratio of lime to sulphur was studied, and the ratio of these materials in solution was found not to be constant as Thatcher supposed (Wash. Bul. 76) but to vary primarily with increase in density. Thus in dilute solutions the ratio occasionally ran as low as 1 to 1.8 while in dense concentrates it averaged about 1 to 25, with individual cases much higher. Owing to losses in

making and impurities in the best of our commercial limes, however, we found definitely that for orchard conditions the best ratio of ingredients is approximately one pound of high calcium lime to two pounds of sulphur.

In connection with the matter of concentration, the relation existing between volume, density and ultilization of materials was determined. The greater densities, obtainable with lower volumes of concentrate, were shown to be associated with less economical use of materials, and hence to be undesirable. Where storage conditions are to be met, however, a final volume of 1 to 1.1 gallons of total product is about right in the home preparation, for the weights of ingredients named above. Otherwise somewhat greater volumes may be used, diluting according to density in all cases.

The sediment in properly made concentrates was found to actually occupy less than 10 per cent. of the total volume, though by settling alone it apparently occupied 30 to 50 per cent. Most of it is unobjectionable in the home preparation, but for more readily remedying its coarser portions, we have recently made a new type of strainer, the construction of which is shown in the accompanying figure. The usual clogging is avoided in it by straining upward, the coarse particles falling away from the screen instead of accumulating on it as in other strainers.

The amount of sediment was found to be influenced by the manipulation, by the ratio and purity of the materials, and by the amount of boiling. The best index for completed boiling is the evident dissolving of the sulphur granules.

Ordinary winter temperatures were found not to exert any permanent effect on the concentrates, the only danger in freezing apparently being the possible breakage of containers, and the freezing points lowered with increase in density, acids and carbon dioxid, however, readily break down the solution.

In connection with the use of lime-sulphur, the first definite system of dilution according to density was developed, foliage tests were made, some of the conditions influencing spray injury were determined, and the thorough control of scale on apple by summer applications alone was demonstrated. This was accomplished with three sprays, the first being applied immediately after the young began to emerge with the others following at intervals of about ten days, where additional young were observed. The amount of spray injury was found not to depend exactly upon density of application, but rather upon the density attained on the leaf before evaporation is complete. This was affected by the abundance of application, the density of the material applied, and the size and location of the drops retained by the leaves, the younger leaves and under surfaces being most vulnerable. Injury is also especially liable to occur after applications of bordeaux or after previous applications of lime-sulphur which have broken the epidermis. This accounts for some of the anomalous cases of severe injury that have come to our attention during the last two seasons.

The recent work at various stations cannot be adequately treated in the present space. The general outburst of activity along all lines of sulphur sprays has been quite remarkable. The excellent work of Scott at Washington in showing the usefulness of the self-

boiled preparation, especially in the control of peach diseases, and also of Quaintance in showing its value in the summer control of scale on peach are worthy of special note. Wallace's extensive work at Cornell against apple diseases, his development of a laboratory method of testing fungicides, his demonstration of the special value of the lime-sulphur-lead-arsenate combination, and his emphasis of the relation between broken epidermises, by scab or insects, and lime-sulphur injury are also noteworthy. This injury is thus brought in line with that of Bordeaux, as pointed out by Crandall in Illinois, and with that of arsenicals, as pointed out by Gillette in Iowa (Iowa Bul. 16, 1890). Parrott, at Geneva, has demonstrated the value of sulphur sprays against blister mite, and has shown the worthlessness of the sediment against scale. Van Slyke and Bosworth at the same place have emphasized the general undesirability of magnesium in the lime used in the ingredients; and Waite at Washington has called attention to possible values of copper and iron sulphids. Besides these workers, Taylor in Missouri, Fulmer and Caesar in Ontario, Bonns in Maine, Ballard and Volck in California, and many others are doing their share in the present movement of advancing, verifying and perfecting our knowledge of the making and use of sulphur sprays, and still there is work to be done.

THE SUMMER SPRAYING OF PEACHES

By J. P. STEWART, *State College, Pa.*

During the season of 1910, an opportunity was offered to the Department of Experimental Horticulture, at State College, to make some further studies on the summer spraying of peaches. A block of trees in the extensive orchard of Mr. W. Fred Reynolds of Bellefonte was very kindly offered for this purpose, and the necessary additional assistance was provided in the Department. The results secured, though not conclusive in all cases, are believed to be of sufficient interest to warrant presentation at this time, especially as a report of progress.

The primary object of spraying peach orchards in summer is to control brown rot. The control of curculio is a pre-requisite for this, and the practical prevention of peach scab, the black spotted disease that often cracks the fruit and makes it more or less lopsided, is incidentally secured. The object in our work was essentially to try out the best known method of accomplishing these ends, and to compare it with other available sprays in order to secure possible improvements. The relative safety of these sprays upon the foliage and fruit was also considered, as well as their effect upon the carrying quality of the fruit in shipment.

In the experiment, a block of some 280 trees about 10 years old were chosen. The peach trees were Early Crawford, which had

been planted as fillers among apples, every fourth tree being the latter. This variety was chosen especially because in previous years it had shown more rot than the others in the orchard, and its trees were well covered with blossoms.

OUTLINE OF THE EXPERIMENT

The plan of the experiment involved three sprayings and nine different treatments, with appropriate "buffers" and checks. In the first spraying, all plots except the checks were treated alike, using lead arsenate, lime and water at the rate of 2-2-50. This application was aimed primarily at the curculio and was applied on May 19, just as the calyces or "shucks" were shedding. The second application was made a little less than a month later, on June 11 and 14, the "data" trees being all sprayed on the 11th. At this time the different fungicide and arsenical combinations named below were applied. In the third spraying, the arsenicals were omitted, the application being made on June 24. For best results in controlling the diseases this third application should have been deferred for 3 or 4 weeks, since the fruit proved not to be ready to pick until August 23, or about 8 weeks after our last application, when it should have been only about a month between these dates. All treatments were under the same conditions, however, so that for purposes of comparison the experiment was not appreciably affected.

The materials used in the second and third applications (with arsenicals omitted in the third) were as follows:

Plot 1. Check. (Unsprayed throughout).

Plot II. "Buffer." (Three rows of trees, sprayed as in Plot 3, that were included between the data trees and unsprayed portions to avoid *undue* exposure of the former to sources of infection).

Plot III. Self-boiled lime-sulphur, 8-8-50; and lead arsenate, 2 pounds to 50 gallons. (Made as described by Scott, in U. S. D. A., Bur. of Ent. Cir. 120:5-7; and B. P. I. Bul. 174. 1910).

Plot IV. Lime-sulphur solution, 1,003; and lead arsenate, 2-50; applied lime-sulphur solution in all cases was made as described by the writer in Penna. Bul. 99, 1910. A density of 1,003 is approximately equal to a dilution of 1 to 100 of our best commercial lime sulphurs, those testing 1.30 Sp. Gr. or 33½° Baume).

Plot V. Lime-sulphur solution, 1.003; and arsenate of lime, 2 pints to 50 gallons. (The arsenate of lime here and in Plot VIII was made as described in Penn. Bul. 99).

Plot VI. Lime-sulphur solution, 1,003; and lead arsenate 8-50; applied with carbon dioxide gas sprayer. (This was expected to eliminate the burning by precipitating the sulphur, without losing the fungicidal action).

Sulfocide, 1 to 400; and arsenate of lime, 2 pints to 50 gallons. was not advocated by the manufacturer but was tried to determine results, since we had evidence that the Paris Green recommended was unsatisfactory).

Plot VIII. Sulfocide, 1 to 400; and arsenate of lime, 2 pints to 50 gallons. (Tried for reasons indicated in VII).

Plot IX. Pyrox, 5 pounds to 50 gallons of water. (This is a commercial preparation of Bordeaux and Lead Arsenate, which has given good results on apples. It was tried here a little stronger than the manufacturers recommended, but apparently is not desirable for peaches, as later results show).

Plot X. Bordeaux, ½-pound copper sulfate, 6 pounds lime to 50 gallons water; and lead arsenate, 2-50. (This spray was formed by doubling the amount of $CuSO_4$ in the next for comparison with it.

Plot XI. Bordeaux, ¼-6-50; and lead arsenate, 2-50. (This spray was recommended as having been in successful use for several years, in Van Lindley orchards of Southern Pines, North Carolina).

Plot XII. Buffer. (Sprayed like XI. See Plot II).

Plot XIII. Check. (Unsprayed).

The plots were adjoining and contained 20 trees each in double rows, excepting II and XII, which contained 30 trees each, in three rows. The data on all plots were taken from 5 or 6 central trees, thus providing in all cases a "buffer" of at least three sprayed rows between the sprayed data trees and unsprayed conditions. It will be noted that the experiment contains six sulphur treatments, and three Bordeaux.

THE WEATHER

The weather during the time of the experiment was as follows:

MAY 15-30

Date	Temperature			
	Maximum	Minimum	Mean	Precipitation
15,	56	38	47	0
16,	66	34	50	0
17,	70	40	55	0
18,	66	48	57	19
19,	76	48	62	0
20,	72	53	63	.23
21,	78	60	69	.20
22,	75	55	65	Trace
23,	67	56	62	.02
24,	80	57	69	.75
25,	72	55	64	.65
26,	63	46	55	0
27,	60	40	50	Trace
28,	74	47	62	0
29,	77	45	56	.10
30,	61	49	55	0
31,	50	41	46	Trace

JUNE

Date	Temperature			
	Maximum	Minimum	Mean	Precipitation.
1,	52	40	46	.13
2,	64	44	54	Trace
3,	62	47	55	.47
4,	67	40	54	0
5,	59	51	55	.58
6,	72	51	62	.03
7,	60	47	54	.02
8,	74	45	60	0
9,	69	45	57	.47
10,	59	49	54	.12
11,	58	50	54	.69
12,	62	52	57	.15
13,	72	50	61	0
14,	78	55	67	0
15,	81	56	69	0
16,	69	59	64	.28
17,	80	60	70	Trace
18,	80	61	71	.07
19,	83	60	72	0
20,	87	59	73	0
21,	88	59	74	0
22,	87	64	76	0
23,	88	64	76	0
24,	80	62	71	0
25,	80	50	65	0
26,	78	55	67	.0
27,	81	64	73	.01
28,	80	60	70	.77
29,	84	60	72	0
30,	87	62	75	0

JULY

Date	Temperature			
	Maximum	Minimum	Mean	Precipitation.
1,	80	64	77	0
2,	88	67	78	0
3,	78	65	72	Trace
4,	76	65	71	Trace
5,	79	52	66	0
6,	82	57	70	0
7,	76	57	67	.90
8,	86	64	75	0
9,	86	60	73	.31
10,	87	62	75	.08
11,	86	60	73	0
12,	84	61	73	.81
13,	82	66	74	.35
14,	83	53	68	0
15,	84	60	72	0
16,	85	62	74	.08
17,	73	60	67	.53
18,	74	55	65	Trace
19,	75	51	63	0
20,	81	51	66	0
21,	72	59	66	0
22,	84	60	72	0
23,	85	67	76	.15
24,	91	63	77	0
25,	86	63	75	0
26,	80	62	71	0
27,	83	58	71	Trace
28,	79	61	70	.83
29,	84	54	69	0
30,	80	64	72	.02
31,	75	53	64	0

AUGUST

Date	Temperature			
	Maximum	Minimum	Mean	Precipitation
1,	78	46	62	0
2,	85	54	70	0
3,	88	50	69	0
4,	86	71	79	Trace
5,	74	56	65	0
6,	77	48	63	0
7,	79	53	66	0
8,	72	59	66	.66
9,	77	56	67	.02
10,	74	58	66	.78
11,	80	58	69	.02
12,	80	54	67	0
13,	81	54	68	0
14,	83	58	71	0
15,	84	58	71	0
16,	78	63	71	0
17,	75	66	71	0
18,	73	62	68	.37
19,	75	64	70	.22
20,	77	49	63	0
21,	79	49	64	0
22,	76	60	68	0
23,	82	60	71	0
24,	82	64	73	0
25,	84	64	74	0

RESULTS

Since the injury caused by the spray itself is one of the most important matters in peach spraying, special attention was given to it throughout the experiment. The extent of the injury as well as its nature was noted. The amounts of twig injury and of fruit and leaf-drop were determined by trial counts and estimates. The injury to the picked fruit was determined by the random-sample method described below. The approximate maximum injuries are shown in Table II. These injuries were not all at their maximum at the same time, those from the Bordeaux preparations developing most slowly. The fruit drop recorded against the checks approximates that occurring on the unsprayed trees from various causes, up to picking time.

APPENDIX

APPENDIX

LIST OF PUBLICATIONS OF THE PENNSYLVANIA DEPARTMENT OF AGRICULTURE

ANNUAL REPORTS

*Report of the State Board of Agriculture, 336 pages, 1877.
*Report of the State Board of Agriculture, 625 pages, 1878.
*Report of the State Board of Agriculture, 560 pages, 1879.
*Report of the State Board of Agriculture, 557 pages, 1880.
*Report of the State Board of Agriculture, 646 pages, 1881.
*Report of the State Board of Agriculture, 645 pages, 1882.
*Report of the State Board of Agriculture, 645 pages, 1883.
*Report of the State Board of Agriculture, 648 pages, 1884.
*Report of the State Board of Agriculture, 645 pages, 1885.
*Report of the State Board of Agriculture, 646 pages, 1886.
*Report of the State Board of Agriculture, 650 pages, 1887.
*Report of the State Board of Agriculture, 648 pages, 1888.
*Report of the State Board of Agriculture, 650 pages, 1889.
*Report of the State Board of Agriculture, 594 pages, 1890.
*Report of the State Board of Agriculture, 600 pages, 1891.
*Report of the State Board of Agriculture, 640 pages, 1892.
*Report of the State Board of Agriculture, 713 pages, 1893.
*Report of the State Board of Agriculture, 646 pages, 1894.
*Report of the Department of Agriculture, 878 pages, 1895.
*Report of the Department of Agriculture, Part 1, 820 pages, 1896.
*Report of the Department of Agriculture, Part 2, 444 pages, 1896.
*Report of the Department of Agriculture, Part 1, 897 pages, 1897.
*Report of the Department of Agriculture, Part 2, 309 pages, 1897.
*Report of the Department of Agriculture, 894 pages, 1898.
*Report of the Department of Agriculture, Part 1, 1082 pages, 1899.
*Report of the Department of Agriculture, Part 2, 368 pages, 1899.
*Report of the Department of Agriculture, Part 1, 1010 pages, 1900.
*Report of the Department of Agriculture, Part 2, 348 pages, 1900.
*Report of the Department of Agriculture, Part 1, 1040 pages, 1901.
*Report of the Department of Agriculture, Part 2, 464 pages, 1901.
*Report of the Department of Agriculture, Part 1, 1030 pages, 1902.
*Report of the Department of Agriculture, Part 2, 324 pages, 1902.
*Report of the Department of Agriculture, 958 pages, 1903.
Report of the Department of Agriculture, 790 pages, 1904.
Report of the Department of Agriculture, 846 pages, 1905.
Report of the Department of Agriculture, 690 pages, 1906.
Report of the Department of Agriculture, 565 pages, 1907.
Report of the Department of Agriculture, 690 pages, 1908.
Report of the Department of Agriculture, 806 pages, 1909.
Report of the Department of Agriculture, 714 pages, 1910.

BULLETINS

No. 1.* Tabulated Analyses of Commercial Fertilizers, 24 pages, 1895.
No. 2.* List of Lectures of Farmers' Institutes, 36 pages, 1895.
No. 3.* The Pure Food Question in Pennsylvania, 38 pages, 1895.
No. 4.* Tabulated Analyses of Commercial Fertilizers, 22 pages, 1896.

*NOTE.—Edition exhausted.

No. 5.* Tabulated Analyses of Commercial Fertilizers, 38 pages, 1896.
No. 6.* Taxidermy; How to Collect Skins, etc., 128 pages, 1896.
No. 7.* List of Creameries in Pennsylvania, 68 pages, 1896.
No. 8.* Report of State Horticultural Association, 108 pages, 1896.
No. 9.* Report of Dairymen's Association, 96 pages, 1896.
No. 10.* Prepared Food for Invalids and Infants, 12 pages, 1896.
No. 11.* Tabulated Analyses of Commercial Fertilizers, 22 pages, 1896.
No. 12.* Road Laws for Pennsylvania, 42 pages, 1896.
No. 13.* Report of Butter Colors, 8 pages, 1896.
No. 14.* Farmers' Institutes in Pennsylvania, 92 pages, 1896.
No. 15.* Good Roads for Pennsylvania, 42 pages, 1896.
No. 16.* Dairy Feeding as Practiced in Pennsylvania, 126 pages, 1896.
No. 17.* Diseases and Enemies of Poultry, 128 pages, 1896.
No. 18.* Digest of the General and Special Road Laws for Pennsylvania, 130 pages, 1896.
No. 19.* Tabulated Analyses of Commercial Fertilizers, 40 pages, 1896.
No. 20.* Preliminary Report of Secretary, 126 pages, 1896.
No. 21.* The Township High School, 24 pages, 1897.
No. 22.* Cider Vinegar of Pennsylvania, 28 pages, 1897.
No. 23.* Tabulated Analyses of Commercial Fertilizers, 31 pages, 1897.
No. 24.* Pure Food and Dairy Laws of Pennsylvania, 19 pages, 1897.
No. 25.* Farmers' Institutes in Pennsylvania, 8 pages, 1897.
No. 26.* Farmers' Institutes in Pennsylvania, 74 pages, 1897.
No. 27.* The Cultivation of American Ginseng, 23 pages, 1897.
No. 28.* The Fungous Foes of the Farmer, 19 pages, 1897.
No. 29.* Investigations in the Bark of Trees, 17 pages, 1897.
No. 30.* Sex in Plants, 17 pages, 1897.
No. 31.* The Economic Side of the Mole, 42 pages, 1898.
No. 32.* Pure Food and Dairy Laws, 30 pages, 1898.
No. 33.* Tabulated Analyses of Commercial Fertilizers, 42 pages, 1898.
No. 34.* Preliminary Report of the Secretary, 150 pages, 1898.
No. 35.* Veterinary Medicines, 23 pages, 1898.
No. 36.* Constitutions and By-Laws, 73 pages, 1898.
No. 37.* Tabulated Analyses of Commercial Fertilizers, 40 pages, 1898.
No. 38.* Farmers' Institutes in Pennsylvania, 8 pages, 1898.
No. 39.* Farmers' Institutes in Pennsylvania, 88 pages, 1898.
No. 40. Questions and Answers, 206 pages, 1898.
No. 41.* Preliminary Reports of the Department, 189 pages, 1899.
No. 42.* List of Creameries in Pennsylvania, 88 pages, 1899.
No. 43.* The San Jose Scale and other Scale Insects, 22 pages, 1899.
No. 44.* Tabulated Analyses of Commercial Fertilizers, 62 pages, 1899.
No. 45.* Some Harmful Household Insects, 13 pages, 1899.
No. 46.* Some Insects Injurious to Wheat, 24 pages, 1899.
No. 47.* Some Insects Attacking Fruit, etc., 19 pages, 1899.
No. 48.* Common Cabbage Insects, 14 pages, 1899.
No. 49.* Methods of Protecting Crops, etc., 20 pages, 1899.
No. 50.* Pure Food and Dairy Laws of Pennsylvania, 33 pages, 1899.
No. 51.* Tabulated Analyses of Commercial Fertilizers, 69 pages, 1899.
No. 52.* Proceedings Spring Meeting of Round-up Meeting, Farmers' Institute Managers, etc., 296 pages, 1899.
No. 53.* Farmers' Institutes in Pennsylvania, 1899-1900, 94 pages, 1899.
No. 54.* Tabulated Analyses of Commercial Fertilizers, 163 pages, 1899.
No. 55.* The Composition and Use of Fertilizers, 126 pages, 1899.
No. 56. Nursery Fumigation and the Construction and Management of the Fumigating House, 24 pages, 1899.
No. 57. The Application of Acetylene Illumination to Country Homes, 85 pages, 1899.
No. 58. The Chemical Study of the Apple and its Products, 44 pages, 1899.
No. 59. Fungous Foes of Vegetable Fruits, 39 pages, 1899.
No. 60.* List of Creameries in Pennsylvania, 33 pages, 1899.
No. 61.* The Use of Lime in Pennsylvania Soils, 170 pages, 1900.
No. 62. A Summer's Work Abroad in School Grounds, Home Grounds, Play Grounds, Parks and Forests, 34 pages, 1900.
No. 63. A Course in Nature Study for Use in the Public Schools, 119, pages, 1900.
No. 64. Nature Study Reference Library for Use in the Public Schools, 22 pages, 1900.
No. 65. Farmers' Library List, 29 pages, 1900.
No. 66.* Pennsylvania Road Statistics, 98 pages, 1900.
No. 67. Methods of Steer Feeding, 14 pages, 1900.
No. 68.* Farmers' Institutes in Pennsylvania, 90 pages, 1900.
No. 69.* Road Making Materials of Pennsylvania, 104 pages, 1900.
No. 70.* Tabulated Analyses of Commercial Fertilizers, 97 pages, 1900.

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*NOTE.—Edition exhausted.

No. 71. Consolidation of Country Schools and the Transportation of Scholars by use of Vans, 89 pages, 1900.
No. 72.* Tabulated Analyses of Commercial Fertilizers, 170 pages, 1900.
No. 73. Synopsis of the Tax Laws of Pennsylvania, 132 pages, 1901.
No. 74.* The Repression of Tuberculosis of Cattle by Sanitation, 24 pages, 1901.
No. 75.* Tuberculosis of Cattle, and the Pennsylvania Plan for its Repression, 263 pages, 1901.
No. 76. Co-operative Investigation into the Agricultural Seed Supply of Pennsylvania, 50 pages, 1901.
No. 77.* Bee Culture, 101 pages, 1901.
No. 78.* List of County and Local Agricultural Societies, 10 pages, 1901.
No. 79. Rabies, 28 pages, 1901.
No. 80.* Decisions of the Department of Agriculture on the Pure Food Act of 1895, 20 pages, 1901.
No. 81. Concentrated Commercial Feeding Stuffs in Pennsylvania, 136 pages, 1901.
No. 82.* Containing the Law Creating a Department of Agriculture in Pennsylvania, and giving the Various Acts of Assembly Committed to the Department for Enforcement: Together with Decisions and Standards Adopted with Reference to the Pure Food Act of 1895, 90 pages, 1901.
No. 83.* Tabulated Analyses of Commercial Fertilizers, 132 pages, 1901.
No. 84. Methods of Steer Feeding; the Second Year of Co-operative Experiment by the Pennsylvania State Department of Agriculture and the Pennsylvania State College Agricultural Experiment Station, 16 pages, 1901.
No. 85.* Farmers' Institutes of Pennsylvania, 102 pages, 1901.
No. 86.* Containing a Complete List of Licenses granted by the Dairy and Food Commissioner, from January 1, 1901, to July 1, 1901, etc., 422 pages, 1901.
No. 87.* Giving Average Composition of Feeding Stuffs, 42 pages, 1901.
No. 88.* List of Creameries in Pennsylvania, 33 pages, 1901.
No. 89.* Tabulated Analyses of Commercial Fertilizers, 195 pages, 1901.
No. 90. Treatment of San Jose Scale in Orchard and Nursery, 33 pages, 1902.
No. 91. Canning of Fruits and Vegetables, 57 pages, 1902.
No. 92.* List of Licenses Granted by the Dairy and Food Commissioner, 193 pages, 1902.
No. 93.* The Fundamentals of Spraying, 35 pages, 1902.
No. 94. Phosphates—Phosphatic or Phosphoric Acid Fertilizers, 87 pages, 1902.
No. 95.* County and Local Agricultural Societies, 12 pages, 1902.
No. 96. Insects Injurious to Cucurbitaceous Plants, 31 pages, 1903.
No. 97. The Management of Greenhouses, 41 pages, 1902.
No. 98. Bacteria of the Soil in their Relation to Agriculture, 88 pages, 1902.
No. 99. Some Common Insect Pests of the Farmer, 32 pages, 1902.
No. 100.* Containing Statement of Work of Dairy and Food Division from January 1, 1902, to June 30, 1902, 223 pages, 1902.
No. 101.* Tabulated Analyses of Commercial Fertilizers, 137 pages, 1902.
No. 102. The Natural Improvement of Soils, 50 pages, 1902.
No. 103.* List of Farmers' Institutes of Pennsylvania, 67 pages, 1902.
No. 104. Modern Dairy Science and Practice, 127 pages, 1902.
No. 105.* Potato Culture, 9 pages, 1902.
No. 106.* The Varieties of Fruit that can be Profitably Grown in Pennsylvania, 50 pages, 1902.
No. 107.* Analyses of Concentrated Commericial Feeding Stuffs, 62 pages, 1903.
No. 108. The Hessian Fly (never printed).
No. 109.* Tabulated Analyses of Commercial Fertilizers, 208 pages, 1903.
No. 110.* Containing Statement of Work of Dairy and Food Division from July 1, to December 31, 1903, 248 pages, 1903.
No. 111.* Small Fruits, their Origin, Culture and Marketing, 66 pages, 1903.
No. 112.* List of County and Local Agricultural Societies, 10 pages, 1903.
No. 113. Methods of Milking, 96 pages, 1903.
No. 114.* Tabulated Analyses of Commercial Fertilizers, 116 pages, 1903.
No. 115. Proceedings of Annual Meeting of Farmers' Institute Managers and Lecturers, 210 pages, 1903.
No. 116.* Farmers' Institutes in Pennsylvania, Season 1903-1904, 64 pages, 1903.
No. 117. Potash Fertilizers—Sources and Methods of Application, 46 pages, 1903.
No. 118.* Containing the Laws Creating the Office of Dairy and Food Commissioner in Pennsylvania, and also a Digest of the Acts of Assembly Committed to his Administration, 62 pages, 1903.
No. 119.* Tabulated Analyses of Commercial Fertilizers, 115 pages, 1903.
No. 120. The Apple-tree-Tent-caterpillar, 46 pages, 1903.
No. 121. Address of Hon. Joseph W. Hunter, State Highway Commissioner,

*NOTE.—Edition not for general distribution.

Delivered at Annual Meeting of State Board of Agriculture, January 28, 1904, 16 pages, 1903.

No. 122.* Analyses of Concentrated Commercial Feeding Stuffs, 52 pages, 1904.

No. 123. Chestnut Culture, 50 pages, 1904.

No. 124.* County and Local Agricultural Fairs, 10 pages, 1904.

No. 125. The Source and Nature of Bacteria in Milk, 41 pages, 1904.

No. 126.* Tabulated Analyses of Commercial Fertilizers, January 1, to August 1, 140 pages, 1904.

No. 127.* Farmers' Institutes in Pennsylvania, 71 pages, 1904.

No. 128. Grape Culture, 62 pages, 1904.

No. 129. Alfalfa Culture in Humid Land, 64 pages, 1904.

No. 130. The Cow-pea in the North, 41 pages, 1904.

No. 131. Proceedings, State Board of Agriculture and Farmers' Normal Institute, 260 pages, 1904.

No. 132.* Analyses of Commercial Fertilizers, August 1, to December 31, 70 pages, 1904.

No. 133. The Improvement of Corn in Pennsylvania, 76 pages, 1904.

No. 134. Proceedings of the Twenty-eighth Annual Meeting of the State Board of Agriculture, 152 pages, 1905.

No. 135.* Analyses of Concentrated Feeding Stuffs, 41 pages, 1905.

No. 136.* List of County and Local Agricultural Societies, 8 pages, 1905.

No. 137. Proceedings, Spring Meeting State Board of Agriculture and Farmers' Annual Normal Institute, 216 pages, 1905.

No. 138.* Analyses Concentrated Commercial Fertilizers, January 1, to August 1, 106 pages, 1905.

No. 139.* Farmers' Institutes in Pennsylvania, 1905-1906, 93 pages, 1905.

No. 140. Sheep Husbandry, 69 pages, 1905.

No. 141.* Laws Relating to the Dairy and Food Division, 47 pages, 1905.

No. 142.* Analyses Concentrated Commercial Fertilizers, August 1, to December 31, 61 pages, 1905.

No. 143. Poultry in Pennsylvania, 36 pages, 1906.

No. 144. Proceedings of 29th Annual Meeting State Board of Agriculture, 191 pages, 1906.

No. 145.* Commercial Feeding Stuffs in Pennsylvania, 51 pages, 1906.

No. 146.* List of County and Local Agricultural Societies, 10 pages, 1906.

No. 147. Market Gardening, 53 pages, 1906.

No. 148 Report of Bee-Keepers' Association of Pennsylvania, 57 pages, 1906.

No. 149.* Analyses Commercial Fertilizers, January 1, August 1, 1906, 80 pages, 1906.

No. 150.* Farmers' Institutes in Penna., for the year 1906-1907, 73 pages, 1906.

No. 151. Proceedings Spring Meeting of State Board of Agriculture and Farmers' Annual Normal Institute, 190 pages, 1906.

No. 152. Fruits of Pennsylvania, 330 pages, 1906.

No. 153.* Analyses Commercial Fertilizers, August 1-December 31, 1906, 60 pages, 1906.

No. 154. Proceedings State Board of Agriculture for 1907, 158 pages, 1907.

No. 155.* Commercial Feeding Stuffs of Pennsylvania for 1906, 47 pages, 1907.

No. 156.* List of County and Agricultural Fairs for 1907, 10 pages, 1907.

No. 157. Proceedings of Farmers' Normal Institute and State Board of Agriculture, 210 pages, 1907.

No. 158.* Farmers' Institutes for year 1907-1908, 78 pages, 1907.

No. 159.* Analyses of Commercial Fertilizers of Spring Samples, 69 pages, 1907.

No. 160.* Laws Relating to Dairy and Food Division, 69 pages, 1907.

No. 161. Papers Read at Farmers' Institutes, 1906-1907, 124 pages, 1907.

No. 162. Breakfast Foods, 40 pages, 1907.

No. 163.* Analyses of Commercial Fertilizers from Fall Samples, 51 pages, 1907.

No. 164. Proceedings State Board of Agriculture, 1908, 210 pages, 1908.

No. 165* List of County and Agricultural Fairs, 1908, 10 pages, 1908.

No. 166. Results of the Analyses of Paris Green, 6 pages, 1908.

No. 167.* Analyses of Commercial Feeding Stuffs, for 1907, 98 pages, 1908.

No. 168.* Preliminary Report Dairy and Food Commissioner, 50 pages, 1908.

No. 169. Proceedings Spring Meeting State Board of Agriculture and Annual Farmers' Normal Institute, 214 pages, 1908.

No. 170. Farmers' Institutes for Season of 1908, 84 pages, 1908.

No. 171.* Analyses of Commercial Fertilizers, January 1, to August 1, 1908, 74 pages, 1908.

No. 172. The Bang Method for the Repression of Tuberculosis in Cattle, 28 pages, 1908.

No. 173.* Analyses of Commercial Fertilizers, August 1, to December 31, 1908, 58 pages, 1908.

No. 174. List of Fertilizer Manufacturers, 1909, 32 pages, 1909.

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*NOTE.—Edition not for general distribution.

No. 175. Analyses of Commercial Feeding Stuffs, 1908, 148 pages, 1909.
No. 176. Analyses of Paris Green, 1908, 31 pages, 1909.
No. 177. Proceedings State Board of Agriculture, 180 pages, 1909.
No. 178. List of County and Local Agricultural Fairs, 10 pages, 1909.
No. 179. Papers Read at Farmers' Institutes, 1907-1908, 105 pages, 1909.
No. 180.* Laws Dairy and Food Bureau, 69 pages, 1909.
No. 181. Timely Hints to Horsebreeders, 23 pages, 1909.
No. 182. Proceedings Farmers' Annual Normal Institute and Spring Meeting State Board of Agriculture, 231 pages, 1909.
No. 183.* Report of Dairy and Food Bureau, 57 pages, 1909.
No. 184. Farmers' Institutes for Pennsylvania, 1909, 79 pages, 1909.
No. 185.* Analyses of Commercial Fertilizers, January 1, to August 1, 1909, 87 pages, 1909.
No. 186. Swine Husbandry, 127 pages, 1909.
No. 187. Directory of Stallions Registered with Pennsylvania Livestock Sanitary Board, for 1909, 86 pages, 1909.
No. 188. Principles of Domestic Science, 42 pages, 1909.
No. 189. Analyses of Commercial Fertilizers, August 1, to December 31, 1909, 71 pages, 1909.
No. 190. The Potato: Selection of Seed and Cultivation, 62 pages, 1910.
No. 191. List of Fertilizer Manufacturers and Brands Licensed for 1910, 38 pages, 1910.
No. 192. Analyses of Paris Green for 1909, 38 pages, 1910.
No. 193. Proceedings Thirty-third Annual Meeting State Board of Agriculture, 192 pages, 1910.
No. 194. Preliminary Report, Dairy and Food Commissioner, 40 pages, 1910.
No. 195. List of Agricultural Fairs for 1910, 10 pages, 1910.
No. 196. Commercial Feeding Stuffs of Pennsylvania for 1909, 186 pages, 1910.
No. 197. Proceedings Farmers' Annual Normal Institute and Spring Meeting of Board of Agriculture, 260 pages, 1910.
No. 198. Farmers' Institutes in Pennsylvania, Season 1910-1911, 84 pages, 1910.
No. 199. Tabulated Analyses of Commercial Fertilizers, Spring Samples, 72 pages, 1910.
No. 200. Skim-milk Cheese, 16 pages, 1910.
No. 201. Market Gardening, No. 2, 86 pages, 1910.
No. 202. Marketing Horticultural Products, 86 pages, 1910.
No. 203. Tabulated Analyses of Commercial Fertilizers, Fall Samples, 76 pages, 1910.
No. 204. Analyses of Paris Green, 1910, 34 pages, 1910.

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*NOTE.—Edition not for general distribution.

FERTILIZER VALUATIONS—1910

The object of an official valuation of commercial fertilizers is to enable the consumer to judge approximately whether he has been asked to pay for a given brand more than the fertilizing ingredients it contains and market conditions prevailing at the time would warrant. It is clear, therefore, that no attempt is made in this valuation to indicate whether the fertilizer valued possesses a greater or less crop-producing capacity than another fertilizer; but only whether it is higher priced than another of the same general composition.

For this purpose the valuation must be so computed as to include all the elements entering into the cost of a fertilizer as it is delivered to the consumer. These elements may conveniently be grouped as follows:

1. The wholesale cost of the ingredients.
2. The jobbers' gross profit on the sale of the ingredients; this includes office expenses, advertising, losses, etc.; for the purpose of the present computation it may be assumed that the sum of this gross profit and the wholesale cost of the ingredients, is equivalent to the retail price of the single ingredients near the wholesale markets in ton lots of original packages for cash.
3. The expense and profit of mixing: This item applies only to complete fertilizers, rock and potash, and ammoniated rock; not to dissolved or ground bone, or to dissolved rock.
4. The expense and profit of bagging.
5. Agents' commission: This item includes not only the commission proper, but every advance in price due to the sale of the goods through an agent in small quantities on time, rather than directly to the consumer in ton lots for cash.
6. Freight from the wholesale market to the point of delivery.

The valuations for 1909 were based:

1. Upon the wholesale prices from September 1, 1908, to March 1, 1909, of the raw materials used in fertilizer manufacture, the quotations of the New York market being adopted for all materials except acidulated phosphate rock and ground bone.
2. Upon an allowance of 20 per cent. of the wholesale prices, above mentioned, to cover jobbers' gross profit.

By adding the 20 per cent. allowed for jobbers' gross profit to the wholesale price of the several raw materials, the retail price in original packages at the jobbers' warehouse is obtained.

Since the amount of the several valuable fertilizing constituents in the various raw materials is known, it is a simple matter to determine the corresponding retail value per pound of the valuable fertilizing constitutents yielded by each raw material. A schedule of these pound values affords a convenient basis of computation of the value per ton of various fertilizers, whose composition is ascertained by analysis.

The values assigned, for the present, to the other elements in the cost of the fertilizer at the point of delivery are:

3. For mixing, $1.00 per ton.

4. For bagging, $1.00 per ton, in all cases except those in which the article was sold in original packages; the cost of the package being, in such cases, included in the wholesale price.

5. For agents' commission, 20 per cent. of the cost of the goods f. o. b. at the jobbers' or mixers' warehouse.

6. For freight, $2.00 per ton; the cost of the freight in dots of twelve tons or over, from the seaboard to Harrisburg, averaging $1.88 per ton.

The following valuation of dissolved South Carolina rock illustrates the method:

Phosphoric acid.	Per cent.	Weight per ton.	
Soluble,	11.50	230 lbs. at 3¼c.	$7 47
Reverted,	2.50	50 lbs. at 2½c.	1 25
Insoluble,	1 00	20 lbs. at 1½c.	30
Retail cash value of ingredients,			$9 02
Bagging,			1 00
Cash value of goods ready for shipment,			$10 02
Agents' commission, 20 per cent.,			2 00
Freight,			2 00
Commercial value per ton,			$14 02

It is not to be expected, of course, that the valuation thus computed will precisely represent the fair price to be charged for a brand in each locality and in every transaction. Market conditions, competition, distance from factory, all introduce minor variations. Nevertheless, to make the approximation reasonably close the average valuation of a given class of goods ought to agree closely with its ascertained average selling price. Whenever such an agreement is no longer obtained by the use of a schedule, it is evident that the schedule of retail values of the constituents, or the added allowances for mixing, etc., requires revision.

It is needful to note here another factor greatly affecting the practical accuracy of these approximations. Their computation would offer little difficulty and their usefulness be far greater, if, by the ordinary methods of analysis, the exact nature of the ingredients used to supply the several fertilizer constituents, were capable of certain determination. This is, however, possible to-day to only a limited extent. The valuations are therefore based on the assumption that the fertilizers are uniformly compounded from high quality ingredients, such as are commonly employed in the manufacture of fertilizers of the several classes. Consumers should carefully avoid the error of accepting such valuations as infallible; they are not designed to be used for close comparisons of single brands, but only to indicate whether the price asked for a fertilizer is abnormal, assuming good quality for the ingredients used. From this it is clear that, *except as high freights may require, the selling price of*

a brand should not far exceed the valuation; but that a fertilizer may be made of inferior materials and yet have a high valuation.

The valuations used during 1908 were modified for use during 1909 in accordance with the changes in wholesale prices of fertilizing ingredients and to make the valuations more closely follow the selling price.

The following comparative statement shows the valuations and selling prices of the several classes of fertilizers during 1905 to 1909:

Fertilizers	Number of samples	Valuation	Selling price	Difference of valuation from selling price
Spring, 1905				
Complete,	374	25.60	24.63	.97
Rock-and-potash,	82	15.49	16.11	—.62
Dissolved bone,	3	22.70	23.83	—1.13
Ground bone,	27	26.72	29.08	—2.36
Dissolved rock,	47	13.86	13.64	.22
Fall, 1905				
Complete,	285	22.35	21.39	.96
Rock-and-potash,	74	15.04	15.97	—.97
Dissolved bone,	6	25.85	24.78	1.11
Ground bone,	35	28.70	27.70	1.00
Dissolved rock,	49	13.51	14.21	1.30
Spring, 1906				
Complete,	412	24.76	23.55	1.21
Rock-and-potash,	99	15.19	16.17	—.98
Dissolved bone,	4	22.65	24.40	—1.75
Ground bone,	34	28.23	29.02	—.79
Dissolved rock,	45	12.98	13.75	—.77
Fall, 1906				
Complete,	266	22.90	21.87	1.12
Rock-and-potash,	71	15.06	15.76	—.70
Dissolved bone,	7	25.33	22.06	3.27
Ground bone,	34	29.12	27.80	1.32
Dissolved rock,	43	12.99	13.45	—.46
Spring, 1907				
Complete,	424	26.84	24.60	2.24
Rock-and-potash,	103	16.63	16.94	—.31
Dissolved bone,	6	25.08	22.28	2.80
Ground bone,	27	29.64	31.55	—1.91
Dissolved rock,	41	14.72	14.64	.08
Fall, 1907				
Complete,	280	24.50	22.71	1.88
Rock-and-potash,	96	15.82	16.58	—.76
Dissolved bone,	8	27.61	22.09	5.52
Ground bone,	36	28.80	28.92	.12
Dissolved rock,	48	14.67	14.76	.09
Spring, 1908				
Complete,	455	26.23	15.69	.54
Rock-and-potash,	108	16.24	16.96	—.62
Dissolved bone,	4	23.09	21.11	1.98
Ground bone,	21	28.96	29.04	—.08
Dissolved rock,	33	14.92	14.72	.20

Fertilizers	Number of samples	Valuation	Selling price	Difference of valuation from selling price
Fall, 1908				
Complete,	287	23.88	22.34	1.54
Rock-and-potash,	104	16.17	16.43	—.26
Dissolved bone,	6	26.05	22.48	3.57
Ground bone,	30	27.90	29.18	—1.28
Dissolved rock,	49	14.86	14.31	.55
Spring, 1909				
Complete,	426	25.31	24.88	—.43
Rock-and-potash,	111	15.94	16.98	—1.40
Dissolved bone,	8	21.57	22.25	—.68
Ground bone,	24	30.28	30.70	—.42
Dissolved rock,	33	13.62	14.76	—1.14
Fall, 1909				
Complete,	255	22.25	22.07	.14
Rock-and-potash,	92	15.50	16.10	—.60
Dissolved bone,	3	22.85	24.50	—1.64
Ground bone,	26	28.71	29.39	—.68
Dissolved rock,	41	14.02	13.86	.16

The following statement from the weekly reports of the Oil, Paint and Drug Reporter, of New York City, shows the average wholesale prices of fertilizer raw materials from September 1, 1908, to March 1, 1909, and from September 1, 1909, to March 1, 1910:

Wholesale Prices of Fertilizer Ingredients, New York, Oil, Paint and Drug Reporter

Substance	Amount priced	Average price September 1, 1908, to March 1, 1909.	Average price September 1, 1909, to March 1, 1910	Prices September-March, 1909-10, in per cent. of prices 1908-09
Sulphate of ammonia,	Cwt.,	2.8999	2.6547	91.2
Nitrate of soda,	Cwt.,	2.166	2.0941	96.7
Dried blood, H. G.,	Unit (20 lbs.),	2.6587	2.8558	107.3
Concentrated tankage,	Unit (20 lbs.),	2.26	2.4783	109.6
Rough bone,	Ton,	19.57	20.9271	106.9
Bone meal,	Ton,	22.49	21.7812	96.8
Fish guano, dry,	Unit (20 lbs.),	2.772	2.9191	105.2
Phosphate rock, Charleston,	Ton,			
Phosphate rock, Tennessee,	Ton,	5.67	5.25	92.6
Acid phosphate,	Unit (20 lbs.),	.5684	.575	101.2
Double manure salt,	Cwt.,	1.165	1.1554	99.2
Sulphate of potash,	Cwt.,	2.18	2.1696	99.5
Kainit,	Ton,	8.50	8.477	99.7
Muriate of potash,	Cwt.,	1.90	1.8833	99.1
Sulphuric acid, 66 degrees B.,	Cwt.,	1.05	1.05	100.0

In ammoniates such as dried blood and fish guano, the unit is of ammonia, of which 82.35 per cent. is nitrogen; in acid phosphate, the unit is of phosphoric acid (phosphorus pentoxid).

There has been a slight increase in prices in blood, bone and tankage, due to the increased demand for this class of ammoniates caused by the export business, which has taken practically all of the cottonseed meal out of the country.

Nitrate of soda and sulphate of ammonia, however, showed a gradual falling off in price.

Acid phosphate is slightly higher, while phosphate rock shows a decrease in price compared with last year, the price per short ton having remained constant throughout the year at $5.25, for Tennessee phosphate.

Potash Salts: The reports of the U. S. Bureau of Statistics show the following entries for consumption during the fiscal year 1908 and 1909:

	1908	1909
Muriate (pounds),	236,949,002	297,837,838
Kieserit, kainit, etc., (tons),	329,467	

The price of potash salts remained the same as last year until the middle of February, when sales were made at slightly lower figures than the old schedule called for, the syndicate having issued no definite new price schedule up to date.

Muriate, 80 per cent., per 100 pounds,	1.885
Sulphate, 48 per cent., per 100 pounds,	2.17
Double manure salt, 48-53 per cent., per 100 pounds,	1.15
Kainit, 12.4 per cent., actual potash, per ton,	8.25
Manure salt, 20 per cent. potash, per ton,	14.68

Composition of Raw Materials.—In order to form a correct idea of the cost per pound of the fertilizer constituents of these materials, it is needful to determine their composition or, in other words, the quantities of valuable constituents each contains. The following table shows the composition of the raw materials used in the manufacture of fertilizers. No analysis of these materials, with the exception of ground bone and dissolved rock, have been made in Pennsylvania. The figures in the following table include the averages of the results of analyses made in Connecticut, New Jersey and Massachusetts during the past year, except in the case of ground bone and dissolved rock phosphates, where Pennsylvania results alone are included.

Composition of Non-Acidulated Fertilizer Ingredients. (Per Cent.)

	Number of samples analyzed	Nitrogen	Potash	Total phosphoric acid
Sulphate of ammonia,	9	20.06	----------	----------
Nitrate of soda,	49	15.39	----------	----------
Dried blood,	13	10.82	----------	----------
Ground bone,	71	2.91	----------	24.36
Tankage,	43	5.95	----------	12.70
Ground fish,	63	8.05	----------	7.40
Cottonseed meal,	260	6.94	----------	----------
Castor pomace,	10	5.06	----------	----------
Sulphate, of potash, H. G.,	18	----------	50.42	----------
Muriate of potash,	42	----------	51.42	----------
Kainit,	18	----------	13.19	----------
Double sulphate of potash and magnesia,	7	----------	27.26	----------

Composition of Acidulated Fertilizer Ingredients (Per Cent.)

	Number of samples	Total phosphoric acid	Soluble phosphoric acid	Reverted phosphoric acid	Insoluble phosphoric acid	Nitrogen
Dissolved bone,	3	13.05	6.25	4.55	2.25	1.93
Dissolved rock phosphate,	41	15.38	10.35	3.86	1.17	----------

Cost per Pound of Fertilizer Constituents.—With the composition of these raw materials and their price per ton, hundred weight, or other unit of measure as a basis, the wholesale cost per pound of the valuable constituents can readily be calculated. In many cases the ammoniates are quoted "per unit of ammonia," the term unit being equivalent to per cent.; in goods sold by the ton of 2,000 lbs., the unit is equal to 20 lbs., and 20 lbs. of ammonia contain 16.47 lbs. of nitrogen.

In the case of refuse bone-black, unacidulated, the mean, 28.25 per cent. of phosphoric acid, is assumed to represent the average material on the market.

Phosphate rock is sold by the ton of 2,240 lbs., and on the basis of the bone phosphate of lime it contains, with drawbacks for injurious constituents. Bone-phosphate of lime contains 45.8 per cent. of phosphoric acid; therefore, each per cent. of bone phosphate in a long ton is equivalent to 22.4 lbs., and contains 10.26 lbs. of phosphoric acid.

In the wholesale trade, dried blood, azotine, concentrated tankage and hoof meals are usually sold on the basis of ammonia, disregarding the phosphoric acid present.

Insoluble phosphoric acid in dissolved rock is likewise omitted from consideration, contracts being based solely upon the "available" phosphoric acid; nor in rock phosphates is any claim made for the small quantities of nitrogen and potash they contain, nor in dissolved bone for the potash present.

Under these conditions, the wholesale cost per pound in New York of the valuable constituents of such materials as furnish but a single fertilizing element, these materials being assumed to be in the state of preparation and in the packing in which the manufacturer purchased them, are given in the following table; also a figure representing a fair retail price at the factory, the materials having undergone no change in treatment or packing and the allowance for expenses and profit in retailing being 20 per cent.

Wholesale Cost per Pound of Fertilizing Constituents, (New York)

I. INGREDIENTS SUPPLYING ONE CONSTITUENT.

Materials	Constituent Valued	Wholesale price, cents	Wholesale prices plus 20 per cent., cents
Sulphate of ammonia,	Nitrogen,	13.23	15.88
Nitrate of soda,	Nitrogen,	13.61	16.33
Dried blood,	Nitrogen,	17.34	20.81
Concentrated tankage,	Nitrogen,	15.04	18.05
Phosphate rock,*			
Tennessee, 78 per cent.,	Phosphoric acid, total,	.656	.787
Acid phosphate,	Phosphoric acid, available,	2.875	3.45
Double sulphate of potash and magnesia,	Potash,	4.24	5.09
Sulphate of potash,	Potash,	4.32	5.18
Kainit,	Potash,	2.87	3.44
Muriate of potash,	Potash,	3.06	4.39

*The prices of phosphate rock are f. o. b. at the respective points of shipment, not New York. The prices for potash are taken from the schedule of the syndicate, nad those of the remainder from the il, Paint and Drug Reporter.

The value for nitrogen is based upon quotations for concentrated tankage as outlined a year ago. This value is $2.93 per unit of ammonia, which is equivalent to $3.56 per unit of nitrogen.

The average composition of the ground bone and bone meal samples analyzed last fall in Pennsylvania was: Phosphoric acid, 22.23 per cent.; nitrogen, 2.87 per cent.

The prepared bone contains less fat and moisture, and often less nitrogen than ordinary rough bone, but these differences tend, in a measure, to neutralize each other. Assuming for the rough bone quoted in the New York market the same composition as the bone meal sold in Pennsylvania and for the value of the nitrogen $3.56 per unit, as previously stated, the values per pound of the several constituents would be:

Wholesale Cost per Pound of Fertilizer Constituents, New York

II. BONE

Materials	Constituent Valued	Wholesale price, cents.	Wholesale prices plus 20 per cent., cents
Rough bone,	Nitrogen,	17.80	21.36
	Phosphate acid,	2.409	2.89
Ground bone,	Nitrogen,	18.51	22.21
	Phosphate acid,	2.49	2.90

Valuation in Neighboring States

It is desirable, from all points of view, that the schedules of valuation throughout a district in which similar market conditions prevail, should differ as little as possible. It has been our practice in the past, to conform our schedule to that adopted after very careful co-operative study of market conditions for each year, by the New England States, New York and New Jersey, except where the peculiar conditions of our markets have made the valuations diverge too largely from the actual selling prices, as in the case of ground bone and dissolved rock phosphates. The schedules for these States for 1909 and 1910 are as follows:

Trade Values Adopted by the New England States and New Jersey

	Cents per Pound		Values in 1910 in per cent. of those in 1909
	1909	1910	
Nitrogen:			
In ammonia salts,	17	16	97.0
In nitrates,	16½	16	94.1
In dry and fine ground fish, meat blood and mixed fertilizers,	19	20	105.3
In fine ground bone and tankage,	19	20	105.3
In coarse bone and tankage,	14	15	107.1
Phosphoric acid:			
Water soluble,	4.0	4½	112.5
Citrate soluble,	3½	4	114.3
In fine ground bone and tankage,	3½	4	114.3
In coarse bone and tankage,	3.0	3½	116.7
In mixed fertilizers, insoluble,	2.0	2	100.0
Potash:			
In forms free from muriate,	5	5	100.0
As muriate,	4½	4½	100.0

Valuations in Pennsylvania

For reasons stated on the previous page, the New England schedule has been followed in the case of mixed fertilizers and dissolved bones.

In the case of the dissolved rocks, the wholesale prices of raw materials used in their manufacture and of the available phosphoric acid itself, having shown no material change, the values used in the Pennsylvania schedule for 1909 were continued for use during the present year.

In the case of ground bones, the commercial valuations for the fall of 1909 were somewhat less, on the average, than the retail market prices; moreover, the wholesale prices of bone showed some advance during the fall and winter. The valuations and market prices have therefore been brought into closer agreement by a slight increase of the values assigned to bone nitrogen, the change at this point corresponding in direction to that for organic nitrogen in general.

The entire schedule adopted for use in this State is presented in the following table:

Pennsylvania Schedule of Values for Fertilizer Ingredients, 1910

	Cents per Pound
Nitrogen:	
In ammonia salts,	16
In nitrates,	16
In meat, dried blood and mixed fertilizers,	20
In fine ground bone and tankage,	17
In coarse bone and tankage,	15
Phosphoric acid:	
Soluble in water in bone fertilizers,	4½
Soluble in water, in rock fertilizers,	3½
Soluble in ammonium citrate, in bone fertilizers,	4
Soluble in ammonium citrate, in rock fertilizers,	2½
Insoluble in ammonium citrate, in bone fertilizers,	2
Insoluble in ammonium citrate in rock fertilizers,	1½
In fine bone, tankage and fish,	3
In coarse bone and tankage,	2½
In cottonseed meal, castor pomace and wood ashes,	3½
Potash:	
In high grade sulphate or forms free from muriate,	5
As muriate,	4½

Potash in excess of that equivalent to the chlorin present, will be valued as sulphate, and the remainder as muriate.

In certain cases where specific claim is made by the manufacturer that potash has been added as carbonate, potash in excess of that equivalent to soluble chlorides and soluble sulphates will be valued as carbonate.

Nitrogen in mixed fertilizers will be valued as derived from the best sources of organic nitrogen, unless clear evidence to the contrary is obtained.

Phosphoric acid in mixed fertilizers is valued at bone phosphoric acid prices, unless clearly found to be derived from rock phosphate.

Bone is sifted into two grades of fineness: Fine, less than 1.50 inch in diameter; coarse, over 1-50 inch in diameter.

The result obtained by use of this schedule does not cover the items of mixing, bagging, freight and agents' commission. To cover these, allowances are made as follows:

For freight, an allowance of $2.00 per ton on all fertilizers.

For bagging, an allowance of $1.00 per ton on all fertilizers, except when sold in original packages.

For mixing, an allowance of $1.00 per ton on complete fertilizers aad rock-and-potash goods.

For agents' commission, an allowance of 20 per cent. is added to the cash value of the goods ready for shipment.

FERTILIZER ANALYSES JANUARY 1, TO AUGUST 1, 1910

Since January 1, 1910, there have been received from authorized sampling agents eighteen hundred and nine fertilizer samples, of which six hundred and sixty-nine were subjected to analysis. Preference is given to those which have not been recently analyzed. In cases where two or more samples representing the same brand were received, equal portion from several samples were united, and the composite sample was subjected to analysis.

The samples analyzed group themselves as follows: 436 complete fertilizers, furnishing phosphoric acid, potash and nitrogen; 8 dissolved bones, furnishing phosphoric acid and nitrogen; 123 rock-and-potash fertilizers, furnishing phosphoric acid and potash; 47 acidulated rock phosphates, furnishing phosphoric acid only; 24 ground bones, furnishing phosphoric acid and nitrogen, and 31 miscellaneous samples, which group includes substances not properly classified under the foregoing heads.

The determinations to which a complete fertilizer is subjected are as follows: (1) Moisture, useful for the comparison of analyses, for indication of dry condition and fitness for drilling, and also of the conditions under which the fertilizer was kept in the warehouse. (2) Phosphoric acid—total, that portion soluble in water, and of the residue, that portion not soluble in warm ammonia citrate solution (a solution supposed to represent the action of plant roots upon the fertilizer), which is assumed to have little immediate food value. By difference, it is easy to compute the so-called "reverted" acid, which is the portion insoluble in water but soluble in the citrate. The sum of the soluable and reverted is commonly called the "available" phosphoric acid. (3) Potash soluble in water—most of that present in green sand marl and crushed minerals, and even some of that present in vegetable materials such as cotton-seed meal, not being included because insoluble in water even after long boiling. (4) Nitrogen—This element is determined by a method which simply accounts for all present, without distinguishing between the quantities present in the several forms of ammonium salts, nitrates or organic matter. (5) Chlorin—this determination is made to afford a basis for estimating the proportion of the potash that is present as

chlorid or muriate, the cheaper source. The computation is made on the assumption that the chlorin present, unless in excess, has been introduced in the form of muriate of potash; but doubtless there are occasional exceptions to this rule. One part of chlorin combines with 1.326 parts of potash to form the pure muriate; knowing the chlorin, it is, therefore, easy to compute the potash equivalent thereto. (7) In the case of ground bone, the state of sub-division is determined by sifting through accurately made sieves; the cost of preparation and especially the promptness of action of bone in the soil depends very largely on the fineness of its particles the finer being much more quickly useful to the plant.

The preceding paragraph sets forth the nature of the examinations given to the several classes of fertilizers under the laws in force prior to the present year. The legislation of 1909 has made needful, however, some additional tests. Sec. 4, of the Act of May 1, 1909, prohibits the sale of "pulverized leather, hair, ground hoofs, horns, or wool waste, raw, steamed, roasted, or in any form, as a fertilizer, or as an ingredient of a fertilizer or manure, without an explicit statement of the fact." All nitrogenous fertilizers have, therefore, been submitted to a careful microscopic examination, at the time of preparing the sample for analysis, to detect the presence of the tissues characteristic of the several materials above named. The act of April 23, 1909, makes it unlawful to use the word "bone" in connection with, or as a part of the name of any fertilizer, or any brand of the same, unless the phosphoric acid contained in such fertilizer shall be the product of pure animal bone. All fertilizers in whose name the word "bone" appears, were therefore examined by microscopic and chemical methods to determine, so far as possible with present knowledge, the nature of the ingredient or ingredients supplying the phosphoric acid. It is a fact, however, well known to fertilizer manufacturers and which should be equally understood by the consumer, that it is, in certain cases, practically impossible to determine the source of the phosphoric acid by an examination of the finished fertilizer. The microscope shows clearly the structure of raw bone, but does not make it possible to discriminate between thoroughly acidulated bone and acidulated rock. The ratio of nitrogen to phosphoric acid in a raw bone—and only such bone as has not been deprived of any considerable proportion of its nitrogenous material by some manufacturing process can properly be called "pure animal bone"—is about 1:8; in cases where the ratio of nitrogen to phosphoric acid exceeds 8, it is clear that part, at least, of the phosphoric acid has been supplied by something else than pure animal bone; but, inasmuch as nitrogen may have been introduced in some material other than bone and no longer detectible by the microscope, the presence of nitrogen and phosphoric acid in the proportions corresponding to those of bone is not proof positive that they have been supplied by bone. Finally, the differences in the iron and silica content of bone and rock respectively, afford means of distinction useful in some cases; the usefulness of this distinction is limited, however, by the facts that kitchen bone frequently contains earthy impurities rich in iron and silica, and that earthy fillers can legally be used in fertilizers and are in fact considerably used therein both as "make-weights" and as "conditions," or materials introduced to

improve the drilling qualities of the goods. The fact that the phosphoric acid in bone and rock are identical in character is probably so well known as to require no detailed consideration of the fact in this connection.

The law having required the manufacturer to guarantee the amount of certain valuable ingredients present in any brand he may put upon the market, chemical analysis is employed to verify the guaranties stamped upon the fertilizer sacks. It has, therefore, been deemed desirable in this report to enter the guaranty filed by the manufacturer in the office of the Secretary of Agriculture, in such connection with the analytical results that the two may be compared. An unfortunate practice has grown up among manufacturers of so wording the guaranty that it seems to declare the presence in the goods of an amount of a valuable constituent ranging from a certain minimum to a much higher maximum; thus, "Potash, 2 to 4 per cent." is a guaranty not infrequently given. In reality, the sole guaranty is for 2 per cent. The guaranteed amounts given for each brand in the following tables, are copied from the guaranties filed by the maker of the goods with the Secretary of Agriculture, the lowest figure given for any constituent being considered to be the amount guaranteed. For compactness and because no essentially important fact is suppressed thereby, the guaranties for soluble and reverted phosphoric acid have not been given separately, but are combined into a single guaranty for available phosphoric acid; in cases where the maker's guaranty does not specifically mention available phosphoric acid, the sum of the lowest figures given by him for soluble and reverted phosphoric acid is used. The law of 1879 allowed the maker to express his guaranty for nitrogen either in terms of that element or in terms of the ammonia equivalent thereto; since ammonia is composed of three parts of hydrogen and fourteen parts of nitrogen, it is a very simple matter to calculate the amount of one, when the amount of the other is given; the amount of nitrogen multiplied by 1.214 will give the corresponding amount of ammonia, and the amount of ammonia multiplied by 0.824 will give the corresponding amount of nitrogen. In these tables, the expression is in terms of nitrogen.

The laws of 1901 and 1909 abolished this alternative and required that the guaranty shall be given in terms of nitrogen. Many manufacturers after complying with the terms of the law, insert additional items in their guaranties, often with the result of misleading or confusing the buyer; the latter will do well to give heed to those items only that are given as the law requires and that are presented in these tables:

A summary of the analyses made this season may be presented as follows:

Summary of Analyses Made this Season

	Complete fertilizers	Rock and potash	Dissolved bone	Dissolved rock	Ground bone
Number of analyses,	436	123	8	47	24
Moisture, per cent.,	8.40	8.32	7.92	8.36	5.73
Phosphate Acid:					
Total, per cent.,	9.80	11.07	14.84	15.79	22.30
Soluble, per cent.,	5.32	6.39	6.54	10.76	----------
Reverted, per cent.,	2.94	3.68	4.64	3.77	----------
Insoluble, per cent.,	1.54	1.00	3.66	1.26	----------
Potash, per cent.,	5.07	4.10	----------	----------	----------
Nitrogen, per cent.,	1.63	----------	1.43	----------	3.06
Mechanical Analysis of Bone:					
Fine,	----------	----------	----------	----------	66
Coarse,	----------	----------	----------	----------	34
Commercial valuation,	$26 72	$16 14	$21 47	$14 00	$30 29
Average selling price,	25 26	17 16	22 17	14 56	30 19
Commercial value of samples whose selling price is ascertained,	26 63	16 08	21 47	14 00	30 27

The cases of departure of goods from their guaranteed composition observed this season, including only those cases in which it amounted to two-tenths per cent., or more, were as follows:

Summary of Instances of Deficiency from Guaranty

	Complete fertilizers	Rock and potash	Dissolved bone	Dissolved rock	Ground bone
Deficient in four constituents,	1	----------	----------	----------	----------
Deficient in three constituents,	3	3	----------	----------	----------
Deficient in two constituents,	29	5	----------	----------	1
Deficient in one constituent,	98	23	2	3	6
Total number of samples in which deficiencies occur,	126	31	2	3	7

The cases of deficiency noted during the past eleven seasons in the composition of goods as compared with their guaranties, expressed in percentage of the total number of goods of each class analyzed, are as follows:

Percentage of Deficiency 1905-1910

	Spring, 1905	Fall, 1905	Spring, 1906	Fall, 1906	Spring, 1907	Fall, 1907	Spring, 1908	Fall, 1908	Spring, 1909	Fall, 1909	Spring, 1910
Complete fertilizers,	35.3	37.5	45.4	39.5	39.4	39.3	40.0	40 0	39.5	46.3	28.9
Dissolved bone,	†100.0	66.6	50.0	28.5	16.6	25.0	‡50.0	16.6	25.0	*	37.5
Rock and potash,	30.9	33.0	42.4	40.0	43.7	49.0	39.0	38.8	36.2	30.4	25.2
Dissolved rock,	9.3	10.0	28.8	25.6	19.5	27.0	21.2	28.5	33.3	19.5	4.3
Ground bone,	40.0	31.4	49.0	14.7	18.5	27.8	38.0	40.0	20.8	38.4	29.17
All classes except miscellaneous,	32.8	31.4	43.8	35.8	36.1	38.9	38.8	38.3	37.6	39.6	26.5

*Only two samples analyzed for which no guarantees are reported.
†Only two samples analyzed for which guarantees are recorded.
‡Only four samples analyzed.

A comparison of the average composition of all samples of complete fertilizers for which guaranties are recorded with the average of the corresponding guaranties, for several seasons past, including those of this season, follows:

Average Composition and Guaranty Compared

	Average composition. Per cent	Average guaranty Per cent
Spring, 1905		
Phosphoric acid:		
Total,	10.16	9.42
Available,	8.50	7.92
Potash,	4.55	4.22
Nitrogen,	1.61	1.58
Fall, 1905		
Phosphoric acid:		
Total,	10.63	9.62
Available,	8.72	8.13
Potash,	2.90	2.42
Nitrogen,	1.26	1.20
Spring, 1906		
Phosphoric acid:		
Total,	9.73	9.21
Available,	7.88	7.77
Potash,	4.21	3.95
Nitrogen,	1.57	1.53
Fall, 1906		
Phosphoric acid:		
Total,	10.45	9.70
Available,	8.23	8.16
Potash,	3.12	2.95
Nitrogen,	1.32	1.31
Spring, 1907		
Phosphoric acid:		
Total,	9.21	8.50
Available,	8.13	7.83
Potash,	4.55	4.31
Nitrogen,	1.52	1.47

Average Composition and Guaranty Compared—Continued

	Average composition. Per cent	Average guaranty Per cent
Fall, 1907		
Phosphoric acid:		
Total,	10.39	9.42
Available,	8.34	8.07
Potash,	3.18	2.72
Nitrogen,	1.39	1.29
Spring, 1908		
Phosphoric acid:		
Total,	10.07	8.91
Available,	8.29	7.61
Potash,	5.04	4.51
Nitrogen,	1.64	1.59
Fall, 1908		
Phosphoric acid:		
Total,	10.29	9.31
Available,	8.29	7.96
Potash,	3.24	2.94
Nitrogen,	1.24	1.23
Spring, 1909		
Phosphoric acid:		
Total,	9.83	8.98
Available,	8.07	7.66
Potash,	5.07	4.89
Nitrogen,	1.67	1.60
Fall, 1909		
Phosphoric acid:		
Total,	10.13	9.34
Available,	8.27	8.08
Potash,	3.41	3.12
Nitrogen,	1.33	1.26
Spring, 1910		
Phosphoric acid:		
Total,	9.80	8.30
Available,	8.26	7.62
Potash,	5.20	4.68
Nitrogen,	1.63	1.60

It is of interest to note how closely the series of valuations based upon the wholesale price of raw materials in the principal markets during the most important buying season and upon certain average allowances for expenses and profits on the part of the mixer and jobber coincides with the retail prices later ascertained. A comparison for several seasons past is given below:

Comparison of Selling Price and Valuation, 1905-1910

	Selling price	Valuation	Excess of valuation over selling price
Complete fertilizers:			
1905, Spring,	24.63	25.60	.97
Fall,	21.39	22.35	.96
1906, Spring,	23.55	24.76	1.21
Fall,	21.87	22.99	1.12
1907, Spring,	24.60	26.84	2.24
Fall,	22.71	24.59	1.88
1908, Spring,	25.60	26.23	.54
Fall,	22.34	23.88	1.54
1909, Spring,	24.88	25.31	.43
Fall,	22.07	22.25	.14
1910, Spring,	25.26	26.63	1.43
Dissolved bone:			
1905, Spring,	23.83	22.70	—1.13
Fall,	24.78	25.85	1.11
1906, Spring,	24.40	22.65	—1.75
Fall,	22.06	25.33	3.27
1907, Spring,	22.28	25.08	2.80
Fall,	22.09	27.01	4.92
1908, Spring,	22.11	23.09	1.98
Fall,	22.48	26.05	3.57
1909, Spring,	22.25	21.57	—.68
Fall,	24.50	22.85	—1.65
1910, Spring,	22.17	21.17	—.70
Rock and potash:			
1905, Spring,	16.11	15.49	—.62
Fall,	15.97	15.04	—.97
1906, Spring,	16.17	15.19	—.98
Fall,	15.76	15.06	—.70
1907, Spring,	16.94	16.53	—.41
Fall,	16.58	15.82	—.76
1908, Spring,	16.86	16.24	—.62
Fall,	16.43	16.17	—.26
1909, Spring,	16.98	15.94	1.04
Fall,	16.10	15.50	—.60
1910, Spring,	17.16	16.08	—1.08
Dissolved rock:			
1905, Spring,	13.64	13.86	.22
Fall,	12.21	13.51	1.30
1906, Spring,	13.75	12.98	—.77
Fall,	13.45	12.99	—.46
1907, Spring,	14.04	14.72	,68
Fall,	14.16	14.67	.51
1908, Spring,	14.72	14.92	.20
Fall,	14.31	14.86	.55
1909, Spring,	14.76	13.62	—1.14
Fall,	13.86	14.02	.16
1910, Spring,	14.56	14.00	—.56
Ground bone:			
1905, Spring,	29.08	26.72	—2.36
Fall,	27.70	28.70	1.00
1906, Spring,	29.02	28.23	—.79
Fall,	27.80	29.12	1.32
1907, Spring,	31.55	29.64	—1.91
Fall,	28.92	28.80	—.12
1908, Spring,	29.04	28.96	—.08
Fall,	28.18	27.90	—1.28
1909, Spring,	30.70	30.28	—.42
Fall,	29.39	28.71	—.08
1910, Spring,	30.19	30.27	.08

MATERIALS USED IN FERTILIZERS

The microscopic examination of the nitrogenous fertilizers for leather, hair, and other materials the use of which without notice is prohibited by the Act of May 1, 1909, revealed in no case such quantity of any of these substances as might not fairly be regarded as an accidental trace. No instance has been reported by the sampling agents in which a declaration of the presence of such material has been made. It is, however, a matter of quite general knowledge that substances of this kind are being largely used in fertilizer mixtures; but, in most cases at least, only after such treatment as results in the destruction of the characteristic tissues and, at the same time, wholly or partly in that of the organic compounds originally present. The Pennsylvania Agricultural Experiment Station is now conducting under the writer's supervision, an investigation to determine the degree to which the acid treatment usually employed improves the availability of the nitrogen in these substances.

In conformity with the requirements of the Act of April 23, 1909, many firms dropped from the brand names of goods manufactured by them the word "bone" hitherto forming part of said names. Where such change in name appears, it may be taken as evidence that the phosphoric acid is derived, at least in part, from something else than bone. In several cases where the word "bone" remains in the brand name, the composition of the goods makes it clear that the law has been violated. All such cases have been reported for legal action.

FERTILIZER ANALYSES AUGUST 1, TO DECEMBER 31, 1910

Since August 1, 1910, there have been received from authorized sampling agents ten hundred and seventy-seven fertilizer samples, of which four hundred and eighty-seven were subjected to analysis. Preference has been given to those which have not been recenty analyzed. In cases where two or more samples representing the same brand were received, equal portion from several samples were united, and the composite sample was subjected to analysis.

The samples analyzed group themselves as follows: 24 complete fertilizers, furnishing phosphoric acid, potash and nitrogen; 4 dissolved bones, furnishing phosphoric acid and nitrogen; 109 rock-and potash fertilizers, furnishing phosphoric acid and potash; 32 acidulated rock phosphates, furnishing phosphoric acid only; 29 ground bones, furnishing phosphoric acid and nitrogen, and 19 miscellaneous samples, which group includes substances not properly classified under the foregoing heads.

The determinations to which a complete fertilizer is subjected are as follows: (1) Moisture, useful for the comparison of analyses, for indication of dry condition and fitness for drilling, and also of the conditions under which the fertilizer was kept in the warehouse. (2) Phosphoric acid—total, that portion soluble in water, and of the residue, that portion not soluble in warm ammonia citrate solution (a solution supposed to represent the action of plant roots upon the fertilizer), which is assumed to have little immediate food value. By difference, it is easy to compute the so-called "reverted" acid, which is the portion insoluble in water but soluble in the citrate. The sum of the soluble and reverted is commonly called the "available" phosphoric acid. (3) Potash soluble in water—most of that present in green sand marl and crushed minerals, and even some of that present in vegetable materials such as cotton-seed meal, not being included because insoluble in water even after long boiling. (4) Nitrogen—This element is determined by a method which simply accounts for all present, without distinguishing between the quantities present in the several forms of ammonium salts, nitrates or organic matter. (5) Chlorin—this determination is made to afford a basis for estimating the proportion of the potash that is present as chloride or muriate, the cheaper source. The computation is made on the assumption that the chlorin present, unless in excess, has been introduced in the form of muriate of potash; but doubtless there are occasional exceptions to this rule. One part of chlorin combines with 1,326 parts of potash to form the pure muriate; knowing the chlorin, it is, therefore, easy to compute the potash equivalent thereto. (7) In the case of ground bone, the state of sub-division is determined by sifting through accurately made sieves; the cost of preparation and especially the promptness of action of bone in the soil depends very largely on the fineness of its particles the finer being much more quickly useful to the plant.

The preceding paragraph sets forth the nature of the examinations given to the several classes of fertilizers under the laws in force prior to the present year. The legislation of 1909 has made needful, however, some additional tests. Sec. 4, of the Act of May 1, 1909, prohibits the sale of "pulverized leather, hair, ground hoofs, horns, or wool waste, raw, steamed, roasted, or in any form, as a fertilizer, or as an ingredient of a fertilizer or manure, without an explicit statement of the facts." All nitrogenous fertilizers have, therefore, been submitted to a careful microscopic examination, at the time of preparing the sample for analysis, to detect the presence of the tissues characteristic of the several materials above named. The act of April 23, 1909, makes it unlawful to use the word "bone" in connection with, or as part of the name of any fertilizer, or any brand of the same, unless the phosphoric acid contained in such fertilizer shall be the product of pure animal bone. All fertilizers in whose name the word "bone" appears, were therefore examined by microscopic and chemical methods to determine, so far as possible with present knowledge, the nature of the ingredient or ingredients supplying the phosphoric acid. It is a fact, however, well known to fertilizer manufacturers and which should be equally understood by the consumer, that it is, in certain cases, practically impossible to determine the source of the phosphoric acid by an examination of the finished

fertilizer. The microscope shows clearly the structure of raw bone, but does not make it possible to discriminate between thoroughly acidulated bone and acidulated rock. The ratio of nitrogen to phosphoric acid in a raw bone—and only such bone as has not been deprived of any considerable proportion of its nitrogenous material by some manufacturing process can properly be called "pure animal bone"—is about 1:8; in cases where the ratio of phosphoric acid to nitrogen exceeds 8, it is clear that part, at least, of the phosphoric acid has been supplied by something else than pure animal bone; but, inasmuch as nitrogen may have been introduced in some material other than bone and no longer detectible by the microscope, the presence of nitrogen and phosphoric acid in the proportions corresponding to those of bone is not proof positive that they have been supplied by bone. Finally, the difference in the iron and silica content of bone and rock respectively, afford means of distinction useful in some cases; the usefulness of this distinction is limited, however, by the facts that kitchen bone frequently contains earthly impurities rich in iron and silica, and that earthy fillers can legally be used in fertilizers and are in fact considerably used therein both as "make-weights" and as "conditioners," or materials introduced to improve the drilling qualities of the goods. The fact that the phosphoric acid in bone and rock are identical in character is probably so well known as to require no detailed consideration of the fact in this connection.

The law having required the manufacturer to guarantee the amount of certain valuable ingredients present in any brand he may put upon the market, chemical analysis is employed to verify the guaranties stamped upon the fertilizer sacks. It has, therefore, been deemed desirable in this report to enter the guaranty filed by the manufacturer in the office of the Secretary of Agriculture, in such connection with the analytical results that the two may be compared. An unfortunate practice has grown up among manufacturers of so wording the guaranty that it seems to declare the presence in the goods of an amount of a valuable constituent ranging from a certain minimum to a much higher maximum; thus, "Potash, 2 to 4 per cent." is a guaranty not infrequently given. In reality, the sole guaranty is for 2 per cent. The guaranteed amounts given for each brand in the following tables, are copied from the guaranties filed by the maker of the goods with the Secretary of Agriculture, the lowest figure given for any constituent being considered to be the amount guaranteed. For compactness and because no essentially important fact is suppressed thereby, the guaranties for soluble and reverted phosphoric acid have not been given separately, but are combined into a single guaranty for available phosphoric acid; in cases where the maker's guaranty does not specifically mention available phosphoric acid, the sum of the lowest figures given by him for soluble and reverted phosphoric acid is used. The law of 1879 allowed the maker to express his guaranty for nitrogen either in terms of that element or in terms of the ammonia equivalent thereto; since ammonia is composed of three parts of hydrogen and fourteen parts of nitrogen, it is a very simple matter to calculate the amount of one, when the amount of the other is given; the amount of nitrogen multiplied by 1.214 will give the corresponding amount of ammonia, and the amount

of ammonia multiplied by 0.824 will give the corresponding amount of nitrogen. In these tables, the expression is in terms of nitrogen.

The laws of 1901 and 1909 abolished this alternative and required that the guaranty shall be given in terms of nitrogen. Many manufacturers after complying with the terms of the law, insert additional items in their guaranties, often with the result of misleading or confusing the buyer; the latter will do well to give heed to those items only that are given as the law requires and that are presented in these tables:

A summary of the analyses made this season may be presented as follows:

Summary of Analyses Made this Season

	Complete	Rock and potash	Dissolved bone	Dissolved rock	Ground bone
Number of analyses,	294	109	4	32	29
Moisture, per cent.,	9.11	9.21	8.28	8.23	5.20
Phosphoric acid:					
Total, per cent.,	9.72	11.01	14.02	15.56	22.66
Soluble, per cent.,	4.74	6.14	7.07	10.05	----------
Reverted, per cent.,	3.42	3.84	4.00	4.22	----------
Insoluble, per cent.	1.56	1.03	2.95	1.29	----------
Potash, per cent.,	3.52	3.99	----------	----------	----------
Nitrogen, per cent.,	1.29	----------	2.01	----------	3.21
Mechanical analyses of bone:					
Fine,	----------	----------	----------	----------	65.
Coarse,	----------	----------	----------	----------	35.
Commercial valuation:					
Average selling price,	21.76	16.38	25.80	14.01	29.98
Commercial value of samples whose selling price is ascertained,	22.24	16.21	25 70	14.15	31.10

"For the purpose of indicating more specifically to the eye, cases deficient in guarantee, an asterisk has been effixed in the analytical tables where the ingredient has been found less in quantity than the manufacturer guaranteed. Too great emphasis should not be placed upon very slight deficiencies, because very slight imperfections in mixing and slight variations in analysis are practically unavoidable. The asterisk has been used, therefore, only in cases where the deficiencies amount to 0.2 per cent. or more, except where nitrogen has been guaranteed in amounts not higher than 1.0 per cent. in which case an asterisk has been affixed where the deficiency amounts to 0.1 per cent. or more."

The cases of departure of goods from their guaranteed composition observed this season, including only those cases in which it amounted to two-tenths per cent., or more, were as follows:

Summary of Instances of Deficiency from Guaranty

	Complete	Rock and potash	Dissolved bone	Dissolved rock	Ground bone
Deficient in four constituents,	1				
Deficient in three constituents,	1				
Deficient in two constituents,	33	9		1	1
Deficient in one constituents	63	30	1	1	7
Total number of samples in which deficiencies occur,	104	40	1	2	8

The cases of deficiency noted during the past ten seasons in goods as compared with their guaranties expressed in percentage of the total number of goods of each class analyzed, are as follows:

Percentage of Deficiency 1906-1910

	Spring, 1906	Fall, 1906	Spring, 1907	Fall, 1907	Spring, 1908	Fall, 1908	Spring, 1909	Fall, 1909	Spring, 1910	Fall, 1910
Complete fertilizers,	45.4	39.5	39.4	39.3	40.0	40.0	39.5	46.3	28.9	35.9
Dissolved bone,	50.0	†28.5	16.6	25.0	‡50.0	16.6	25.0	*	37.5	25.0
Rock and potash,	42.4	40.0	43.7	49.0	39.0	38.8	36.2	30.4	25.2	37.0
Dissolved rock,	28.8	25.6	19.5	27.0	21.2	28.5	33.3	19.5	4.3	6.3
Ground bone,	49.0	14.7	18.5	27.8	38.0	40.0	20.8	38.4	29.17	27.6
All classes except miscellaneous,	43.8	35.8	36.1	38.9	38.8	38.3	37.6	39.6	26.5	33.5

*Only two samples analysed for which no guarantees are reported.
†Only two samples analyzed for which guarantees are recorded.
‡Only four samples analyzed.

A comparison of the average composition of all samples of complete fertilizers for which guaranties are recorded with the average of the corresponding guaranties, for several seasons past including those of this season, follows:

Average Composition and Guaranty Compared

	Average composition. Per cent	Average guaranty Per cent
Spring, 1906		
Phosphoric acid:		
Total,	9.73	9.21
Available,	7.88	7.77
Potash,	4.21	3.95
Nitrogen,	1.57	1.53
Fall, 1906		
Phosphoric acid:		
Total,	10.45	9.70
Available,	8.23	8.16
Potash,	3.12	2.95
Nitrogen,	1.32	1.31
Spring, 1907		
Phosphoric acid:		
Total,	9.21	8.50
Available,	8.13	7.83
Potash,	4.55	4.32
Nitrogen,	1.52	1.47
Fall, 1907		
Phosphoric acid:		
Total,	10.39	9.42
Available,	8.34	8.07
Potash,	3.18	2.72
Nitrogen,	1.39	1.29
Spring, 1908		
Phosphoric acid:		
Total,	10.07	8.91
Available,	8.29	7.61
Potash,	5.04	4.51
Nitrogen,	1.64	1.50
Fall, 1908		
Phosphoric acid:		
Total,	10.29	9.31
Available,	8.29	7.96
Potash,	3.24	2.94
Nitrogen,	1.24	1.23
Spring, 1909		
Phosphoric acid:		
Total,	9.83	8.98
Available,	8.07	7.66
Potash,	5.07	4.89
Nitrogen,	1.07	1.60
Fall, 1909		
Phosphoric acid:		
Total,	10.13	9.34
Available,	8.27	8.08
Potash,	3.41	3.12
Nitrogen,	1.33	1.26

Average Composition and Guaranty Compared—Continued

	Average composition. Per cent	Average guaranty Per cent
Spring, 1910		
Phosphoric acid:		
Total,	9.80	8.80
Available,	8.26	7.62
Potash,	5.20	4.08
Nitrogen,	1.63	1.60
Fall, 1910		
Phosphoric acid:		
Total,	9.72	8.37
Available,	8.16	7.47
Potash,	3.52	3.09
Nitrogen,	1.29	1.22

It is of interest to note how closely the series of valuations based upon the wholesale price of raw materials in the principal markets during the most important buying season and upon certain average allowances for expenses and profits on the part of the mixer and jobber, coincides with the retail prices later ascertained. A comparison for several seasons past is given below:

Comparison of Selling Price and Valuation, 1903-1910

	Selling price	Valuation	Excess of valuation over selling price
Complete fertilizers:			
1903, Spring,	24.57	24.15	—.42
Fall,	21.98	22.77	.79
1904, Spring,	24.28	24.99	.71
Fall,	21.82	22.53	.71
1905, Spring,	24.63	25.60	.97
Fall,	21.39	22.35	.96
1906, Spring,	23.55	24.76	1.21
Fall,	21.87	22.99	1.12
1907, Spring,	24.60	26.84	2.24
Fall,	22.71	24.59	1.88
1908, Spring,	25.69	26.23	.54
Fall,	22.34	23.88	1.54
1909, Spring,	24.88	25.31	.31
Fall,	22.07	22.25	.14
1910, Spring,	26.26	26.23	1.43
Fall,	21.76	22.24	.48

Comparison of Selling Price and Valuation, 1903-1910—Continued

	Selling price	Valuation	Excess of valuation over selling price
Dissolved bone:			
1903, Spring,	31.17	30.87	—.30
Fall,	23.67	24.57	.90
1904, Spring,	31.50	28.42	—3.08
Fall,	24.94	27.77	2.83
1905, Spring,	23.83	22.70	—1.13
Fall,	24.78	25.85	1.11
1906, Spring,	24.40	22.65	—1.75
Fall,	22.06	25.33	3.27
1907, Spring,	22.28	25.08	2.80
Fall,	22.00	27.01	4.92
1908, Spring,	21.11	23.09	1.98
Fall,	22.48	26.05	3.57
1909, Spring,	22.25	21.57	—.68
Fall,	24.50	22.85	—1.65
1910, Spring,	22.17	21.47	—.70
Fall,	25.80	25.70	—.10
Rock and potash:			
1903, Spring,	17.20	14.77	—2.46
Fall,	15.96	14.86	—1.10
1904, Spring,	16.47	15.46	—1.01
Fall,	15.89	14.92	—.97
1905, Spring,	16.11	15.49	—.62
Fall,	15.97	15.04	—.97
1906, Spring,	16.17	15.19	—.98
Fall,	15.76	15.06	—.70
1907, Spring,	16.94	16.53	—.41
Fall,	16.58	15.82	—.76
1908, Spring,	16.86	16.24	—.62
Fall,	16.43	16.17	—.26
1909, Spring,	16.98	15.94	1.04
Fall,	16.10	15.50	—.60
1910, Spring,	17.16	16.08	—1.08
Fall,	16.38	16.34	—.04
Dissolved rock:			
1903, Spring,	15.13	13.34	—1.75
Fall,	14.64	13.12	—1.52
1904, Spring,	14.59	14.05	—.54
Fall,	13.89	14.00	.20
1905, Spring,	13.64	13.86	.22
Fall,	12.21	13.51	1.30
1906, Spring,	13.75	12.98	—.77
Fall,	13.45	12.99	—.46
1907, Spring,	14.64	17.72	.68
Fall,	14.16	14.67	.51
1908, Spring,	14.72	14.92	.20
Fall,	14.31	14.86	.55
1909, Spring,	14.76	13.62	—1.14
Fall,	13.86	14.02	.16
1910, Spring,	14.56	14.00	—.56
Fall,	14.01	14.15	.15
Ground bone:			
1903, Spring,	28.67	27.25	—1.42
Fall,	27.52	27.07	—.45
1904, Spring,	28.20	27.70	—.50
Fall,	27.02	27.97	.95
1905, Spring,	29.08	26.72	—2.36
Fall,	27.70	28.70	1.00
1906, Spring,	29.02	28.23	—.79
Fall,	27.80	29.12	1.32
1907, Spring,	31.55	29.64	—1.91
Fall,	28.92	28.80	—.12
1908, Spring,	29.04	28.96	—.08
Fall,	28.18	27.90	—1.28
1909, Spring,	30.70	30.28	—.42
Fall,	29.39	28.71	—.68
1910, Spring,	30.19	30.27	.08
Fall,	29.98	31.10	1.12

MATERIAL USED IN FERTILIZERS

The following observations on this head, were made respecting the fertilizers analyzed in the Spring of 1910. They apply equally well to those examined this Fall season.

"The microscopic examination of the nitrogenous fertilizers for leather, hair, and other materials the use of which without notice is prohibited by the Act of May 1, 1909, revealed in no case such quantity of any of these substances as might not fairly be regarded as an accidental trace. No instance has been reported by the sampling agents in which a declaration of the presence of such material has been made. It is, however, a matter of quite general knowledge that substances of this kind are being largely used in fertilizer mixtures; but, in most cases at least, only after such treatment as results in the destruction of the characteristic tissues and, at the same time, wholly or partly in that of the organic compounds originally present. The Pennsylvania Agricultural Experiment Station is now conducting, under the writer's supervision, an investigation to determine the degree to which the acid treatment usually employed improves the availability of the nitrogen in these substances.

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INDEX BY AUTHORS

A

B

C

D

E

F

G

H

K

L

M

P

N

R

S

T

V

W

INDEX OF SUBJECTS

A

B

C

D

E

F

G

L

M

N

O

P

R

S

T

V

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3 5185 00258 5683