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The Grading of Milk as a Substitute for Dairy Inspection.

CHARLES E. NORTH.

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THE GRADING OF MILK AS A SUBSTITUTE FOR DAIRY INSPECTION.

CHARLES E. NORTH, M.D., DIRECTOR, THE NORTH PUBLIC HEALTH BUREAU, NEW YORK CITY.

The title refers to the control of public milk supplies through legislative enactment. Dairy inspection is a function provided for in most State and municipal milk laws, and its general possibilities and activities are familiar to all who are engaged in the milk industry or in official control of the same. Irrespective of the standards, whether by the use of score cards or otherwise, dairy inspection assumes that inspectors acting under the direction either of State or municipal departments will periodically visit certain dairy districts and report on the sanitary conditions which they observe on dairy farms or in the stations established by the industry for shipping or receiving milk. In this work the emphasis is laid on the dairy and the external appearances which can be observed, not only with respect to buildings and equipment, but with respect to the methods used by dairy employees. Such inspection gives no consideration to the product itself, which may be termed the net result of the work of the dairy industry.

In contrast with this, a new form of legislation has been devised which may be summarized in the expression, "the grading of milk." This grading refers to the separation of the product into several grades, according to the sanitary character of each. It is recognized that there may be innumerable degrees of excellence between the most unsanitary and the most sanitary milk produced, but for practical purposes it is sufficient to establish arbitrarily only two or more such divisions. The merits of the grading system do not appear until one fully

appreciates the evidence which now exists showing the remarkable results which can be achieved, even in ordinary dairies by the rank and file of dairy farmers, in the production of milk of the highest sanitary character.

The first step in sanitary milk production must deal with the dairy cow herself. The process of milk manufacture consists in the transformation of the raw material, which is the food consumed by the dairy cow, into the finished product — the milk. This is done through the absorption into the blood of the cow of certain products supplied by the digestive organs. The circulation of the blood carries these materials to the cow's udder and distributes them through all parts of the udder by the subdivision of the arteries into a network of fine branches. The udder itself is an instrument called a gland, which is of such a spongy texture that it is subdivided into numerous small pockets or cavities, all of which empty into channels or canals. These pockets are lined with numerous cells, which are small units of animal matter capable of abstracting from the blood the materials necessary for the formation of milk, and discharging these into the milk canals. In the performance of this act much of the animal matter lining the walls of these canals is destroyed and broken off, so that in addition to the milk flow itself there is a constant shedding of the tissues lining the udder, composed of the finest particles of animal matter, which flow away in the milk. Many of these consist of the white blood cells which flow in the blood, and find their way through the walls and canals into the milk. When the sediment from the milk of a healthy cow is collected by the use of a centrifuge such as a clarifier, under the microscope these cells which have been shed from the walls of the udder can be plainly seen. When the udder of a dairy cow is inflamed the appearance is remarkably changed, showing these cells blurred and in the process of destruction mixed with large numbers of bacteria and often the bacteria can be seen clustered within the bodies of some of the white blood cells, which are actually engaged in their remarkable duty of devouring the bacteria of disease. Such inflammation of the cow's udder is extremely common, and can be found present in the majority of large dairy herds. In producing sanitary milk the farmer must begin by the elimi-

nation from his herd of all cows having sore udders, in addition to other precautions concerning the health of his cows.

Modern control over milk has as its chief basis the bacterial testing of milk. There has been some unnecessary mystery concerning the bacterial testing of milk, especially in the minds of milk producers. As a matter of fact, such tests are rather simple. The various steps can be easily mastered by any bright high school boy or girl. Milk samples must first be taken in properly sterilized sample bottles. These are usually of small size, so that a large number may be conveniently packed in a sampling case and surrounded with cracked ice. To make bacterial testing of practical value to the milk industry it is necessary that the work shall be done on a large scale, and numerous samples tested in a short period of time. This can be done only by instituting the most efficient and simple methods for laboratory work. The milk samples and glassware for testing should be arranged on long tables, high enough to permit the work to be done in a standing position. The operator first shakes the milk sample thoroughly to obtain a perfect mixture. A portion is then drawn up in a small glass tube, called a pipette, to an exact mark measuring 1 cubic centimeter, or about one-third of a teaspoonful. This is then injected into a bottle holding 99 cubic centimeters of sterilized water, which gives a dilution of 1 per cent. The mixture of milk and water is then thoroughly shaken. From the bottle of mixed water and milk a sample is then drawn in a sterile glass pipette to an exact mark amounting to 1 cubic centimeter, and discharged into a small glass dish, called a petri dish, which has been previously sterilized. Upon this is then poured a jelly paste of agar, which is a Japanese seaweed mixed with a beef-tea solution of proper strength. This jelly must be carefully mixed by shaking the dish with the dilution. In a few moments it will harden in the bottom of the glass dish, thereby fixing fast in the jelly all the bacteria which may be in the milk. The dish is then placed in a hot closet, called an incubator, at the same temperature used for the incubation of hens' eggs, where it remains for a period of two days. When first placed in the hot closet the appearance of this glass plate is perfectly transparent. If, however, bacteria are present in the milk, at the end

of two days the plate will show a decidedly spotted appearance. These spots may be very fine or very large, according to the kind of bacteria present. Where each speck of dust or dirt or individual bacterium was present a growth will take place. This corresponds in its nature to the growth observed so frequently when the housewife puts up jelly and through some mistake fails either to boil it thoroughly or properly cover the top. What has actually happened is that the laboratory worker has planted a little garden, using the jelly as soil and the bacteria in the milk as seeds. Bacteria are really tiny plants or vegetables, and grow readily in such soil as this jelly. It is not necessary to use a microscope, but the resulting growth can be readily seen with the naked eye. By counting the number of spots one estimates the number of bacteria originally in the milk.

This bacterial testing has been so perfected that it now furnishes a measure of the sanitary excellence of milk. Where milk has been produced in a clean manner and is fresh the number of bacteria will be very small, sometimes as low as 100 or even less per cubic centimeter (one-third of a teaspoonful of milk). On the other hand, where milk has been produced in an unclean manner or is stale these numbers may run into millions. By the use of this test it is possible to divide milk into several grades, according to the numbers of bacteria which it may contain. The question now is, how good is it possible for the average milk producer to make milk, and what division should be made in establishing such grades?

Milk inspectors are accustomed to condemn dairies which have barns surrounded by trash and filth, and which have cow stables in which floors and walls and ceilings are dusty, covered with cobwebs and accumulations of cow dung. Because of this, twenty-five years ago it was commonly believed that only by the establishment of the most model sanitary cow stables was it possible to produce clean milk. This belief led to the widespread establishment of certified dairies, in which no expense was spared to make the cow stable a model of sanitary excellence, with cement floors and plaster walls, iron stanchions and a complete lighting and ventilating system. Cows in these dairies are groomed twice daily just as carefully as horses are groomed.

The writer acted as manager of a model dairy of this kind for a period of five years. On the same premises was an old-fashioned cow barn used as a place for the temporary residence of dairy cows newly purchased. Some of these would be in milk, and consequently it was always necessary to have some milking done in this old cow stable. This was done by a milker, who transported his sterilized milk cans and covered milking pails back and forth in a wheelbarrow. The milk from this old dairy barn was tested in the bacteriological laboratory, and showed that even under the existing primitive conditions it was possible to produce milk with exceedingly small numbers of bacteria, comparing favorably with milk produced in the sanitary barn. The actual figures for the year 1913 were a monthly average of 3,102 bacteria per cubic centimeter for the old stable, and 1,097 for the model sanitary barn, both of these figures being well within the limits of the standard established for certified milk, which is 10,000 bacteria per cubic centimeter.

This experience was convincing evidence that by the adoption of the simplest sanitary methods clean milk can be produced in ordinary cow stables, and led the writer to undertake to produce large volumes of such milk under commercial conditions.

The first opportunity to do this occurred when the city of New York demanded clean milk at low cost for the use of infants in the tenement house districts, which was to be distributed through municipal milk stores. These stores were at first established by the New York milk committee to the extent of 31, and later were taken over by the city, and at the present time number 55. The milk for these stores is produced at a large shipping station in the village of Homer, New York, 260 miles away, where 71 dairy farmers have been trained to observe the fundamental sanitary precautions necessary for clean milk production, which they do in return for the payment of a small bonus or premium above the regular market price. The milk is all sent in 40-quart cans to a central shipping station located on the railway, where, as the cans are poured into the receiving tank, samples are taken daily by the local bacteriologist and tested in the laboratory in the shipping station. The results are posted on the bulletin board, and the system of payment to the farmers is based on the tests thus made of

this milk. These regular tests furnish a measure of the sanitary character of the milk. The system of payment offers a bonus of 10 cents per can above the regular market for all milk containing less than 10,000 bacteria per cubic centimeter. The stimulation of this bonus has been sufficient to transform all of the milk into this high grade.

The use of a small-mouthed milking pail is a primary factor in securing these results. When one considers that nature has made arrangements whereby each little calf obtains certified milk daily under all sorts of conditions because the milk is protected in the process from external contaminations, it is obvious that the use of a small-mouthed milking pail brought close to the dairy cow can in a similar manner prevent the contamination of milk during its transfer from the dairy cow to this receptacle. In a short time the average milker can readily learn to milk into a milking pail with a mouth only 5 inches in diameter.

An inspection of the 71 dairy barns at Homer, New York, shows them to be of the most ordinary type. In some of them milk is produced containing even less than 1,000 bacteria per cubic centimeter. The score of these dairies, made by a representative of the United States Department of Agriculture, showed that many of those which scored the lowest are producing milk containing the smallest numbers of bacteria.

At this Homer station more than 10,000 quarts of milk are produced and bottled daily for the use of the infant milk depots in New York City.

The writer established a similar shipping station at Sparks, Maryland, for the shipment of milk to Baltimore. Here 28 Maryland farmers were producing over 3,000 quarts of milk daily. The conditions on these dairies were much inferior to the conditions in New York State. The majority of the barns have dirt floors, and the work is performed by negro help. The milk as brought to this station is regularly tested for bacteria by a high school boy, who takes samples daily, and makes his tests in the little bacterial laboratory established in the local high school. Some of the dairy barns at Sparks are over two hundred years old, very badly lighted, and practically without any of the sanitary features required by dairy inspectors.

Nevertheless, the records of the bacterial test show that farm after farm has experienced a progressive reduction in the numbers of bacteria through the observance of simple sanitary precautions. The mixed milk at this station contained in the month of December over 5,000,000 bacteria per cubic centimeter, while in the month of April, due to the installation of the laboratory and the stimulation of the bonus offered, the bacteria in the mixed milk were less than 50,000 per cubic centimeter.

At Oxford, Pennsylvania, the same milk-producing system has been established. Oxford is a very large milk-shipping station to which 98 dairy farmers bring their milk for shipment to Philadelphia. It was not possible immediately to transform such a large group of farmers into clean milk producers. They were, therefore, divided into two classes, 63 of the producers going to one door in the shipping station called the "Grade A department," and the rest of the producers bringing their milk to another part of the building, called the "Grade B department."

In this station the bacterial tests are made by a young lady who was formerly the district school teacher, and who was trained by the writer in making these tests. The stimulation of the tests and the bonus acted with such force on these producers that in a short time all of them graduated into the "Grade A department." The records of individual farmers taken from the laboratory books show in a remarkable manner the reduction of bacteria from many millions under old methods down to a few thousand, and even less than 1,000, as a result of the adoption of new methods.

On one of these dairy farms, in particular, having in the cow stable a ceiling composed of poles, between which the hay overhead hangs down, and with a dirt floor, and with only two tiny windows for lighting, and without any regular cow stanchions, is a barn in which the producer is able to furnish milk containing at times even less than 1,000 bacteria per cubic centimeter. On these same premises this dairyman produced milk which took second prize and a silver cup at the Philadelphia Milk Show, in competition with milk from many model dairies.

The samples taken from the mixed milk of all of these farmers at Oxford show that on October 1 there was a great

reduction in the numbers of bacteria. Whereas before that date the bacteria in the milk had been running in many millions, after that date they were reduced to a few thousand. October 1 is the dividing line between high numbers and low numbers of bacteria. It happens that this was the very date on which the milk dealer offered to pay a bonus to the producers for extra care, and for milk coming up to the bacterial standard of 25,000 bacteria per cubic centimeter. It is impossible to look on these figures without being satisfied that the offering of this bonus was the chief factor in securing results. In other words, the dairy farmer can and will secure results if he is paid for his work.

As a further demonstration of the possibilities of producing clean milk under the auspices of the rank and file of dairy farmers, the writer undertook the following experiment. Ten of the dairy farmers at Oxford, who had been trained for one year in sanitary methods, agreed to accompany the writer to another dairy district and perform the milking operations in strange dairy barns. Precautions had been taken previously to test the milk produced in these other cow stables, which were located at a place called Kelton, Pennsylvania. The laboratory tests of the milk obtained from these dairies showed that it was running very high, containing often millions of bacteria per cubic centimeter. No preparations whatever were made for this test, it being understood that the only changes would be such as the Oxford farmers could themselves bring about on the afternoon of the experiment. When the day arrived the ten Oxford farmers took the train with the writer from Oxford, and on arrival at Kelton, in company with the Kelton producers, drove out to the ten Kelton dairies where the experiment was to be performed. Each Oxford farmer took with him one small-mouthed milking pail. On their arrival at the Kelton dairies the Oxford men took charge of the milking operations, and carried out such sanitary precautions as they were able to perform during the period of milking. In this work they used the same barns, the same cows, the same cooling apparatus and the same milking utensils, with the exception of milking pails. The milk was left in the Kelton dairies over night, and samples were not taken

for bacterial testing until it was delivered at the shipping station the next morning. The results of these tests showed that, whereas in these dairies for the previous six days milk containing millions of bacteria had been produced, the Oxford men were able in one afternoon to produce milk containing, in nine out of ten cases, less than 10,000 bacteria per cubic centimeter.

This seems to be an emphatic demonstration that the man himself is the chief factor in clean milk production. It also shows clearly that it is possible for the rank and file of dairy farmers to furnish milk which is of a very high degree of sanitary excellence, and can conform to a bacterial standard almost as severe as that used for certified milk.

The pasteurization of milk is something that should be endorsed by milk producers, simply because it furnishes a life insurance to the consumers as well as to the milk industry. Nothing is more fatal to the milk dealer's or the producer's financial interest than an epidemic of disease caused by bacteria in milk. No degree of veterinary inspection of cattle, or medical inspection of employees, can entirely protect milk against sudden outbreaks of typhoid fever, scarlet fever, diphtheria and sore throat. All of these bacteria, and even those of tuberculosis, are killed by a temperature of 145° F. for a period of thirty minutes. This can be done without the destruction of any of the food value of milk itself. Pasteurization adds great stability to the milk industry, and should be approved by the producer for financial reasons, if for no other. As a matter of fact, pasteurization can be adopted to advantage even on the dairy farm itself, especially where milk is to be used for infants or children. This can be done by the operation of a small-sized home pasteurizer, using the heat from a kitchen stove. Such machines can be purchased from dairy supply houses, and, in many instances, are effective in preventing an outbreak of disease among children.

We have completely passed the experimental stage in methods of sanitary milk production and pasteurization. It only remains to create a demand for clean and safe milk in our city markets. Such a demand cannot be made effective by the milk dealer himself, for the reason that the public refuses to accept the milk dealer's statements as to the character of the

milk which he has to sell. The only way in which public confidence can be established in a matter of this kind is through the action of the public health authorities. A National Commission on Milk Standards, composed of twenty of the leading public health authorities on milk, has been nominated and financed by the New York milk committee. This commission, after four years of deliberation, has recommended that market milk be divided into three grades, which are identified by the capital letters, A, B and C. "Grade A milk" is the title given to the best milk. Under this grade is included raw milk from tuberculin-tested cows, produced and handled by employees under medical examination, in sanitary dairies, conforming to a standard of from 10,000 to 100,000 bacteria, which is milk corresponding in character to certified milk, and selling for from 15 to 25 cents per quart. But, more important than this, under this same grade is a pasteurized milk which has a standard of from 30,000 to 200,000 bacteria per cubic centimeter before pasteurization, and 10,000 after pasteurization. This milk is more important because it can be furnished to consumers at not more than 10 cents per quart, and it can be produced in ordinary dairy barns. This "Grade A pasteurized milk" is destined to be the household milk of the future. It is the milk upon which the dairy industry is destined to build a new business. This is the milk which will be furnished by the rank and file of dairy farmers, and in the production of which they can secure higher prices.

Already on the New York City market there is for sale over 150,000 quarts per day of this "Grade A pasteurized milk," which is now retailed by practically all of the large milk companies selling milk in New York City. There are 34 shipping stations producing this milk for the city of New York. The State of New York has passed regulations of the same kind, grading the milk supply of the entire State into three grades. The cities of Jersey City and Newark, New Jersey, and Richmond, Virginia, have adopted similar regulations.

This clean milk business has advanced so rapidly that it is the most remarkable event that has occurred in recent years in the dairy business. There is more profit for the milk producer and for the milk dealer, and better milk for the milk consumer.

Quality and price seem to have met, so that at 10 cents a quart we have here the highest milk value at the lowest possible price. Milk producers should, therefore, be heartily in favor of the grading of milk, because it means more money for the farmer at the expenditure of such a small amount of his time that the bonus received is almost clear profit.

The writer has often been asked just what the dairy farmer does to produce Grade A milk. Out of the very long list of sanitary precautions, there are eight which have been selected as of primary importance. If these eight precautions are observed, any milk producer will be successful in sending milk to the shipping station which contains less than 10,000 bacteria. These eight sanitary precautions are as follows: —

1. Use small-mouthed, covered, milking pails.
2. Keep cow's udders clean.
3. Milk with dry hands.
4. Sterilize pails and cans and all other utensils with an abundance of boiling water.
5. Beware of milk strainers. Use only cheese cloth, washed and boiled before each use.
6. Beware of open coolers. Cool night's milk, winter and summer, by placing cans in tanks of cold water, ice water, or running water preferred.
7. Beware of wooden paddles or stirring rods. Use only metal stirring rods scalded before using.
8. Pay a bonus to hired help based on bonus earned by the milk.

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DOMESTIC SCIENCE TEACHING IN RURAL DISTRICTS.

SARAH TYSON RORER.

FROM THE SIXTY-THIRD ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

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DOMESTIC SCIENCE TEACHING IN RURAL DISTRICTS.

(MRS.) SARAH TYSON RORER, COLEBROOK, PENNSYLVANIA.

In 1877 and 1878 the women's clubs of Boston and Philadelphia decided that the United States needed what England had already established, — schools of cookery. These schools were crude but practical. The New Century School in Philadelphia followed the Boston school; both were under the care and guidance of their respective clubs and supported by private contributions. Miss Juliet Corson of New York had done a tremendous amount of pioneer work, following the methods of Professor Blot and Miss Dodd. In many of our large cities her thoughts and aims were directed entirely toward the betterment of the homes of the poor. She was my preceptor, and a most remarkable and misunderstood woman, but her earnestness and honesty made a great impression on all of her pupils, especially myself. She proved to me that cookery was not drudgery — it was the occupation of educated women because it was the building material for human beings.

After much hard work on the part of the clubs and the pioneer teachers we were able to secure rooms in a few of the public high school buildings for school demonstrations. These were supported by the clubs. The lessons, to save expense, were necessarily short. The work was really not practical. For instance, a child in the morning class would draw half of a chicken, and the remaining half would be left for a pupil in the afternoon class, thus saving the expense of two chickens. The little "housekeepers" were taught, in groups of four, to sweep and dust the schoolroom, which was in no way applicable to the home kitchen they knew; nor was there in this teaching the slightest attempt to improve either the architecture or the

cooking of the home kitchen. School cookery and home cookery were from the first not interchangeable, nor were the pupils urged to use the school cookery at home.

The idea of cookery in the public schools grew rapidly, but to convert the taxpayers and the boards of education to this new idea we had to make it very academic, and this at once robbed it of its practical aspect. In the end it dwindled down to the immediate establishment of training schools for teachers of domestic science. These teachers in the majority of cases were young and untrained in the practical science of housewifery; they naturally leaned toward the theoretical work, and many of the reformers who were interested in the movement forgot that domestic science was the training of women for motherhood, and that many of the girls were expected by the taxpayers to be trained for their life occupation.

The system as founded was not intended to make prodigies of learning of our children. Public schools cannot teach everything that is desirable to know, but as long as it can be said that public school domestic science classes do not give instructions of value to the child for home work, the public school is not doing its best nor doing that for which we are being taxed.

The proof of these statements is found in the fact that in all these years of domestic science nothing remarkable has occurred in our clumsy system of housekeeping. We find, especially in many of the country districts, the same old-fashioned kitchens with their heavy iron utensils, earthen bowls, wooden washtubs, used with the same old methods that were in vogue in our grandmother's day. In some parts of the United States the railroad companies send practical home women in private cars to country districts to show the housewife how best to save the vegetables and fruits that she has grown and which would otherwise be thrown away. But these methods, as far as I have observed, lack instructions in systematic work which should be done in the average kitchen. It still means a "canning day," and canning should be done when one must necessarily be in the kitchen looking after other work.

Expensive apparatus does not mean efficiency. The conversion of a workable plain kitchen into an expensive kitchen

laboratory is not practical for the masses, and it is the homes of the masses that make the best citizens for the country.

The health and happiness of the family corresponds to the case with which the housewife accomplishes her daily tasks. Home life is uplifted and made ideal only through the knowledge of the mother backed by the bread-winning capacity of the father. I contend that the public schools of this country are in a great measure responsible for both.

One drawback in the urban districts is a lack of buildings, and teachers who really know how to teach. Both, of course, mean a little more money spent on schools, but why not, — the children of to-day are the men and women of to-morrow, and as we build our children so the men and women. And this also means less crime, fewer houses of correction and a marked decrease in all forms of disease and degeneracy. As it is now, we rush our children through, crowding into a few school years a lot of educational fads — dreams of honest but impractical reformers.

My belief is that all domestic science teachers who teach girls over twelve years of age should have a practical training in the management of a house; they should know considerable about architecture, sanitation, the buying of food supplies, construction of stoves, scientific laundry work, and, if necessary, should be able to tell why the chimney smokes, how to install running water and adjust or regulate the pump; they should be skilled housewives before they enter the teaching field. Teachers in medical schools are as a rule practical physicians. Teachers in schools of domestic science should be practical housekeepers.

Books are valuable in a way, but no one ever learned the art of living without observation and practice. Who would employ a book-learned physician?

Most of the literature on domestic science is superficial, written by people who have no practical knowledge of work: theories are intermingled with everyday needs.

The agricultural schools in the various States have been able to reach the agricultural men, and they have improved in their methods of farming. Why not help the wives to a better way of doing their work? Why not teach them how to use a few

labor-saving machines in a systematic way? How can we expect our boys and girls to stay on the farms unless we make them attractive, and rid ourselves of unnecessary drudgery? The farmer too often narrows the life of his wife and children by his agricultural success. The "stock" is ever uppermost in his mind. He pushes in one direction at the expense of his family — and frequently awakes too late to correct his mistake. His children have gone to more pleasant surroundings, and his wife is simply worn out.

The district schoolhouse should be the center for this work; a small room should be fitted up like a home kitchen with apparatus simple and practical, such as the majority can obtain.

I fully realize that to change all this is a gigantic undertaking, but we have spent millions in agricultural training, why not spend an equal amount on housewifery?

The best and most effective thing I ever did was in the country districts of Canada, where I carried my utensils in a hat box and used plain boards rested on boxes for tables. It is not so much the utensils as it is the woman behind the utensils, but all these questions must be settled by women. While men and women are eternally equal they are eternally different, and our wrongs cannot be righted through the eyes of men, because they do not see things in our light.

Women as a class are not progressive; men are. We are not so much to blame, for we never have had the opportunity to study the mechanical arts that are ever before the men. But the question of domestic science in the country districts must be settled. Are we to go on drudging all our lives? Are we not to be taught the better ways? I hope to see the day that every housewife will give up her broom and dust brush, her scrubbing brush and washboard, and use the better modern appliances that are inexpensive. I hope the cooking of special fancy dishes will give way to simple and attractive foods; company meals to be unheard of, the true hostess placing her guests at the family table without change of food. I hope to see the hostess as free from care during the meal as her guests. I hope to see the woman without a maid learn how to serve a meal in an easy, hospitable way without apology.

I fully realize the importance of the work done by the domestic science teachers. They have in most cities removed the idea of drudgery from the kitchen, and in many places have improved the kitchen architecture and furnishings; but this teaching must not be restricted to certain districts — it must be universal, and for this reason I feel that we are now at the parting of the ways.

I should establish these schools after the fashion of the State tubercular dispensaries — a resident teacher, with lectures and practical work two days each week, and three days to go from house to house helping and suggesting, according to the needs of each housewife. All should be taught economy.

Women as a rule are not wilfully extravagant; in the majority of cases it is sheer ignorance and lack of knowledge of how to use materials. The profession she has undertaken is not one for which she has been trained. The average country mother shields her daughter unwisely from all the unpleasant work that she has done in the kitchen. The daughter is allowed to go to school unhampered; in fact, if she were the daughter of a queen in many instances she could not lead a more idle or more luxurious life. After high school she probably enters college, where she is allowed to take as her major any subject that suits her fancy. She pursues this theme with interest, energy and understanding and graduates with high honors. If she has a fancy for teaching it is satisfied, and she teaches until she has an opportunity to marry. Then everything concerning her profession is dropped; she enters a house, which should be a home, absolutely untrained and unskilled in every way. She is naturally wasteful and clumsy. What man under the same circumstances could do better?

I remember during my active teaching in the Philadelphia Cooking School a young bride entered the practical class — the wrong way, of course, to begin. Practice always follows theory, theory never can follow practice. This woman was making a dish which called for the yolk of an egg, and before I could catch her hand the white was thrown into the garbage bucket. She did not intentionally mean to waste her husband's money, but she did not know that the white should be saved for another dish. I find that most housewives throw

away all small leftovers and then buy new materials for soup and garnishes; instead of arranging meals for an entire week they think up each meal separately, and frequently only a few hours before serving time. I notice that they throw away the drippings from the baking and roast pans and the raw pieces of suet from meat and the fat from the surface of soups, and buy butter, lard and lard substitutes. This, of course, is a double waste — the fats have been paid for at lean meat prices, which makes frying fats cost 25 to 30 cents a pound. More bread is cut for a meal than is actually needed. The slices are either left in the bread-box for a day or two or thrown at once into the garbage bucket. They should at once be wrapped in a damp cloth or made into croutons or bread crumbs, or put aside for toast for breakfast.

Potatoes are pared quickly at the last moment — great whittlings are taken off, carrying with them most of the nourishment and leaving the soggy, watery center portion which lacks nutrition.

Rice is not washed until the last minute, then perhaps boiled in a small quantity of water and served wet and soggy. An admirable food is made indigestible.

Bits of soap are wasted. They should be put aside to melt for laundry and cleaning purposes.

Fires are allowed to burn at full force an hour before they are wanted; then, if it is a coal fire, wood is added at cooking time, which means the waste of both coal and wood.

Where the housewife is her own kitchen maid she need not necessarily live in the kitchen. She can manage her meals, make out her bills of fare and do most of the thinking in her sitting or living room. When meat is put into the oven the fire may be adjusted so that it will cook without constant attention. She must count time and fuel as well as actual money.

The more economical way is to buy just enough for each meal. Leftovers and some of the cheaper cuts of meat frequently cost hours of time, which should to her amount to money, and they also use a great deal of fuel in their preparation.

It is not true economy where the woman is doing her own work to serve her meals in four or five courses. Meals should

be satisfying, or the average country man cannot easily do his work. Plain soups come first and are made quickly, followed by a meat dish with two vegetables and either a simple dessert or a salad; this should form the complete dinner. Select foods that can be all cooked in the oven at one time, or on top of the stove over a single burner.

Desserts should be made during the morning when the housewife is obliged to be in the kitchen.

The kitchen is only one room in the house. To make a home the whole house must be attractive. The sewing and mending must be done, and the housewife must have time for recreation and reading.

I find the country housewife very extravagant in the use of butter, eggs and sugar. Eggs during the winter season are most expensive, and when used in connection with a meat dinner overcrowd the organs that excrete the poison from nitrogenous materials. Fruits and fruit desserts should follow a meat meal.

Try all utensils before you actually purchase them. Do not buy them simply because they are advertised as useful. They frequently are not needed. The meat chopper is a great convenience. Also a bread mixer, a dish washer, a spatula and good French knives. Use each utensil for the proper work, otherwise they will wear out in a very short time. A man does not use a reaper for cutting fodder.

Use cheesecloth for straining rather than a napkin.

A wire dishcloth will clean your pots and pans quickly and save the sharp edges of your knives.

Measure everything you use — a guessing cook is always a wasteful one. She may hit it six times out of ten, but the few failures are very expensive. A tin measuring cup costs but 10 cents, and with care will last a lifetime.

Use blue and white granite or Swedish ware for all utensils; if the table happens to be upset or any accident occurs these utensils are picked up whole and in good condition.

Use an ordinary 5-cent paint brush for greasing pans, and use suet instead of butter. A piece of paper or the fingers are rather extravagant greasing utensils.

Another economy is to know just how much to allow to each

individual for the week. A good allowance of butter, for instance, is a half pound; more than this is wasteful and upsets the balance ration.

Frying is the most objectionable method of cooking. It renders good food difficult of digestion.

Do not spend an extra moment in the kitchen. Do not stand over the kettles or wait for things to cook; busy yourself by preparing something for the next meal, thus shortening your time of work.

Thoughtful and intelligent women in public and private life are, I am quite sure, searching for less elaborate and more simple methods of living. There are numerous pitfalls along the way of eating. An appetite created in a child if allowed to continue leads to intemperance, and intemperance to crime in later life. A simple, well-balanced meal means health. Artificial appetites should never be created or cultivated, and are not, as a rule, except by a mother misled by ignorance, or the careless, indifferent mother who takes particular pains to be kind to her child, and gives it everything it asks for.

Thousands of lives are sacrificed each year through the lack of knowledge on the part of the mother, and this knowledge, by the way, is not incompatible with the other accomplishments. It adds to your power. It teaches you how to be hospitable, and hospitality means home making. It teaches you how to live well on small means, instead of hopelessly wringing your hands and crying out about the high price of food. It teaches you how to keep well and how to build your family.

Let us insist upon our share of instruction, rather than to accept the present condition as inevitable. Let us get together at once and see that every country schoolhouse is converted into a social center, where our housewives, too old to again enter school, can have, at little cost of time, the necessary instructions to make life worth the living.

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THE IMPROVEMENT OF LIVE STOCK.

R. A. Hayne.

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THE IMPROVEMENT OF LIVE STOCK.

R. A. HAYNE, AGRICULTURAL EXTENSION DEPARTMENT, INTERNATIONAL HARVESTER COMPANY, CHICAGO, ILLINOIS.

We all agree on the great fundamental truth, that the soil is the foundation on which depends all material things. All industries, all enterprises, all the doings commonly known as business are activities based on the use or abuse of the providential gifts called natural resources.

When these activities and manipulations are analyzed and followed they are found to be ultimately dependent on the one great resource, — the soil. Take away the soil's productivity, make it barren, and the world's business will stop. Great, because from it directly and indirectly come the food and clothing for mankind. Great, because it is one resource we can use and still keep.

Take the coal and iron out of the earth and they are out for good. Cut off the forests that are counted as resources, and in this generation and the next we cannot grow more trees like them; but the soil was here three hundred years ago when the "Mayflower" landed at Plymouth Rock, waiting for the settlers to clear away patches and begin growing crops, and it is still here through years of neglect and abuse, still growing crops. In some places it has grown thin and the crops light, but that is the fault of the tillers, not of the soil.

It is not my purpose to sharply criticize the methods, or the people who employed them, that have depleted the soil's fertility in the older parts of the United States. The deed is done; we cannot change the past. The first settlers played their part well, better perhaps than we would have done in their places. Criticism of the past will not accomplish good like effort to make best use of the present. We have the situation to meet. We are the keepers of the soil.

In times past the keepers, — or, may I say, the wasters of the soil, — because of mistakes and unorganized effort on their part, have not always been recognized as keepers of the world, yet the fact that they are remains, and some day, not many years away, they will be recognized as such, and the keeper's greatness will be measured not only by the amount and quality of the necessities of life he offers the world, but by his ability to maintain and increase the fertility of his soil, and by the condition in which he hands it to another generation; and this leads me to what I have to say. In the present day it is criminal to follow any longer a plan of farm production that depletes soil fertility, when it has been clearly shown that by a right system and rotation crops can be grown year after year, perhaps indefinitely, and at the same time maintain and increase fertility. And the most practical system of doing this, as we see it, from a scientific and humanitarian point of view, is one in which the crops grown, or at least a large share of them, are fed to live stock, and by the live stock transformed into food and clothing products, while the waste or manure is returned to the fields to help keep up and increase fertility.

We admit that it is possible to farm without live stock, keep up soil fertility and get a fair wage for labor expended, but it is not as practical as the live-stock method for two or three reasons which we will give later.

It does not follow that live stock is a panacea — a cure-all; a bad system of live-stock farming is as bad as a poorly managed system in any other business; the farm can be eaten up and the fertility wasted with live stock as quickly as without it. There is a combination of conditions that must be met before live-stock farming is all that it should be. First, we must have good stock, — stock fitted to environment of location, crops, markets and to the tastes of the farmer; then the feed for the animals must be grown, or at least most of it, on the farm. Profitable stock husbandry is not founded on the purchase of feeds. The feed and care must be supplied intelligently, so the cost will not overrun the income; and perhaps the greatest of all the requirements, the manure must be carefully returned to the soil. When these conditions are met a long step has been taken to care for the fertility; the crops

find a sure and safe market; the farm is put on a business basis, making a factory of it, running the year round, turning out a finished product, keeping the farm force employed winter and summer, — with the steady employment of labor bringing a year-round income that is far from the least of the advantages.

We must have good live stock. In the discussion of live stock the first point I would make is that farm animals are or should be transformers converting vegetation into more useful products; and it is only live stock that does this best that we can afford to have.

The only true value that an animal or breed can have is based on its utility, and not upon some fancy point that has no connection with usefulness. I would say here that when a breeder or organization of breeders spend time and energy developing in their live stock characteristics to gratify an idle whim, something that is no use to humanity, they are on the wrong track; their names will not be listed with those of useful men; and we would say the same to all fair, record, test or breeders' associations. This is a practical world and growing more so. There might be some popular whim that for the moment could be catered to with profit, but such a thing can only be temporary. Because there are ladies who are willing to pay $5 or $100 for a fuzzy dog with burnt cork eyes, one that she can wash and fondle and blanket, is not sufficient reason for any one going into the breeding of such dogs as a life's work. It is men who have lived a life of usefulness that are remembered. I once saw a stallion, a mediocre individual, with exceptionally long mane and tail. His owner rolled the long hair on spools. A circus manager offered $500 for him — it was a great deal more than he was worth. The offer was indignantly refused; the owner was going to start a breed of long-haired circus horses. That horse is dead; there is no breed of long-haired circus horses; the man is dead; his name is not written in history; he was following an idle whim.

We have a present-day example of a horse whim — as far as we Americans are concerned — in the hairy legs of the British draft horses. With all their good qualities they have been rejected by most American horsemen because British

breeders have insisted on adorning their horses legs with something that is of no use to us. I have seen Jersey cattle bred so fine and fawn-like that they were small, delicate and failed to make good at the pail. A man once grew enthusiastic over starting a breed of five-toed chickens. He purchased a common speckled rooster, giving $6 for him, for no reason except that he had five toes. That man is not in the chicken business to-day.

There is a streak in human nature that makes us sometimes prone to go after fads. The pig must have the white feet, and the ear and tail must hang just so. It is nice to have the unessential things, but the useful pig is one that comes from a big litter of thrifty shoates that can convert feed into profitable pork. Whether the black and white color of the cow is in the right proportion and her nose of the right hue should be secondary to her ability to consume much feed and manufacture it economically into milk.

The live stock of any section can be divided into two general classes, — the everyday grade that does the work and supplies the general market, and the pure bred that is developed for the purpose of furnishing blood to improve common stock. These two classes can be divided and subdivided, and one class merges into the other, so a discussion of improvement applies to both.

All live-stock improvements have been brought about by selection, coupled with feeding and care. This combination must be relied upon for future developments. Breeding and selection will not accomplish much without feed and care, and *vice versa*.

When the improvement of live stock is mentioned we at once think of introducing new blood by selecting, buying, importing or bringing from some other section animals that are superior to those we have in our neighborhood. We think and talk about the pure bred, the registered sire, and look to him for our salvation, and it is well that we develop that interest; but let us be sure when the pure-bred sire, the high-priced animal, is introduced into the herd that the chances are, as far as we can determine, in favor of the desired result.

Let me ask, what is a pure-bred animal? A pure-bred animal is one whose ancestors for many generations have all been selected for the same purpose. And if it is to be a valuable animal for the breeder, the ancestors must not only have been selected for that purpose, but they must have accomplished what they were selected for.

The animal is, as far as nature can make it, a combination of its ancestors; it is the ancestors boiled down to one individual. Of course all the characteristics of all the ancestors cannot be pronounced and visible, yet they are likely to be there, dormant, somewhere in its make-up, ready to crop out in the offspring when the right condition or mating occurs.

I do not care to enter into a discussion of Mendel's law in heredity, because to the practical breeder — and it is the practical folks who have to feed and clothe the world — Mendel's law offers but little help. We would emphasize the importance of having as far as possible the ancestors of pure-bred stock on both maternal and paternal sides, — individuals of the type we are aiming to produce. This not only insures uniformity in the pure-bred families, but makes the pure-bred animal better able to stamp his likeness on the offspring when used in the grade herd; in other words, it makes for prepotency. That is a wonderful word in the live-stock world. Prepotent animals — animals that can be relied upon to reproduce themselves — in a measure take away the uncertainty in live-stock production, and after all, that is the real work of pure-bred animals and test and record associations. Take the uncertainty out of any deal and it at once becomes a good deal; we know what to do with it. Many a so-called pure-bred animal has proven a disappointment because in his pedigree there were too many kinds of ancestors and too much inferior quality.

We need to get a better vision of the value of pedigrees. A pedigree is a family history; and the meanest mongrel in New England has as much, perhaps more, family history than the best pure bred. A pedigree to add worth to an animal must be more than a string of names on a sheet of paper, accompanied by a certificate of registration. It must be a family history showing that the animal had ancestors of merit and that they came from flocks and herds of honest men.

I would not enroll myself with the knockers, yet I would refer again to mistakes that are every day being made in the live-stock world. One is spending good money, paying long prices for breeding stock because of a family name or reputation, rather than because of real merit in the animal purchased. Exceptional individuals are produced in all breeds, — individuals that have in a marked degree the qualities the fanciers of the breed are striving for. They fall into good hands, are developed and win prizes or make records; they are often purchased at attractive figures by men who are good boosters, good advertisers; and the lesser lights, the smaller breeders, are much inclined to scramble for an animal carrying the blood of this famous individual, often accepting an inferior specimen in order to introduce the blood and name into their herd. It is well to have great individuals. If they reproduce themselves they are blessings, but remember that their descendants have another side to their ancestral line that may wreck the good that comes from the great head of the family.

In one of our campaigns for better farming we met in South Dakota a young horseman who was eager to show his recent purchase, — a Percheron stallion, a grandson of Carnot. Carnot is a great horse, a winner in France; a winner in America; proven beyond doubt a wonderful sire. His owner is a booster, a good advertiser, and Carnot blood is much sought for. This young man showed a stallion with the Carnot style and grace; a beauty at a distance, but with a pair of crooked, boggy hind legs, weak in one place where draft horses should be exceptionally strong. He had purchased him from a dealer, and I learned was given his choice between this toppy, bad-legged colt and a smooth, solid young stallion with faultless legs and feet that was the product of several generations of careful breeding by a corn-belt farmer who was not given to boasting or printer's ink; his horses were not known. The young man had spent his money and taken chances on the grandson of Carnot — with perhaps generations of bad-legged mothers in his family — just to get the glamor of reputation and advertising, while the solid colt with a quiet carefully built history was no doubt worth many times more as a reproducer.

A would-be dairyman exhibited the head of his herd, calling special attention to the fact that his bull was a son of one of the famous dairy sires. He was all that, and at the same time he was the offspring of a common low-grade cow that had been mated with the great sire. There is a belief, and it is worthy of consideration in the selection of sires, that sons inherit and transmit in a larger measure the characteristics of their mothers than they do of their sires. Whether this is true or not, the fact remains that constructive breeders pay much attention to the maternal side. I have often heard Mr. A. J. Nicholl of New York say that were he selecting a sire for his grade dairy herd, and could not get a pure-bred bull whose dam was a better producer than the best-grade cow in his own herd, he would surely use the son of his best-grade cow.

Another mistake often made by stockmen is sending into a far-off State for sires and new blood, when in the next county, or a little way down the road, there may be a breeder whose stock has blood and individuality equal to, perhaps better than, that secured after a long journey. Oftentimes, after the transportation charges are settled and the animal is installed in its new home, the purchaser is painfully surprised to find how ordinary is his new pig or calf or colt.

Let me mention, too, the mistake — often followed by regrets — of selling a sire before his worth is known. This applies especially in dairy breeding.

A bull's worth, as a breeder, is not definitely known until his daughters have freshened the second time. This means the bull must be at least five years old before he can be discarded as a failure. Not many dairy bulls reach that age. They go to the butcher and are replaced by untried sires. The error is too often made of registering and offering as improvers all the young stuff in pure-bred herds. Not all of the increase of any herd is fit for registration. Registration, when thus abused, is really a hindrance to stock improvement. This practice is not carried on in all herds — far from it; but it is done enough so that young and inexperienced stockmen sometimes buy inferior animals because they have pedigrees and cer-

tificates of registration attached, only to find their mistakes later. Such work embitters the new breeder and keeps the quality of pure-bred stock at a low average.

In live-stock improvement let not the selection for individual excellence and breeding overshadow the importance of an equal consideration of feed and care. Let us not forget that improved live stock, as we have already indicated, is the product of good breeding, strongly coupled with good feeding. The improved animal is an overdraft on nature, the old stock being transformed to meet artificial conditions; and it follows that to retain and continue improvement these factors must not in any way be neglected. When the improving influences are discontinued the tendency is to revert to the ancestral type, and the characteristic last acquired is apt to be the first lost; for example, the dairy cow that we are so proud of is not many generations removed from the wild cow that could fight her way for life and feed, and gave enough milk to keep her calf alive until it was four months old and then went dry. By bestowing feed and care, together with careful selection, we have improved her to her present excellence in milk production; but turn her out, let her fight her way again, and if she does not die in the transformation her year-round milking inclination will vanish and her descendants will take on the type of the old-time cow.

The tendencies are against improvement. For this reason live-stock improvement is an upstream proposition. It is a task for men of intelligence, judgment and character.

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Breeding and Selecting Fowls for Egg Production.

JAMES E. RICE.

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BREEDING AND SELECTING FOWLS FOR EGG PRODUCTION.

JAMES E. RICE, PROFESSOR OF POULTRY HUSBANDRY, CORNELL UNIVERSITY
ITHACA, NEW YORK.

The burden of my song to-day will be the efficiency of the hen, but before entering upon the discussion of this subject I want to express my appreciation of the honor and the privilege of returning so many times to speak before your State Board of Agriculture. I think that we have made wonderful progress throughout this country in very recent years in agriculture. We have made greater progress, in my judgment, in the past ten years than in the preceding hundred years, and that is saying a great deal; and truly, poultry husbandry has, for one reason or another, come out of the realm of a side issue or a one-person business on the farm, and has now become a well-established commercial enterprise worthy of the best men and worthy of capital and confidence in the business. In other words, because of our increased knowledge of how to successfully handle poultry enterprises, poultry husbandry is not now, in my judgment, to be considered as one of the risky, hazardous occupations, but one of the well-established, conservative and profitable occupations. As an evidence of this fact we can point literally to hundreds of farms in New York State and in Massachusetts, and literally to thousands of them in the United States, where 1,000 or 2,000 hens or more are being kept profitably, and more profitably than most other branches of agriculture that could be followed in those same districts. I was talking with one of the most successful farmers in our State a few weeks ago, a man who has been so successful that his two sons have been trained especially for farm work and are back on the farm, in partnership with him; a man who has such a big farm and is handling it so well that he has 11 miles of tile drains on his farm, and who grows many acres of many crops,

and who keeps careful accounts, and I asked him the question, "Which branch of your farming do you look upon now as being your most profitable, permanent, reliable, staple standby?" He answered, as quickly as he could get the words out of his mouth, "Poultry and asparagus." Now we cannot get behind those facts; we cannot, in any way, question those statements when men of substantial means and intelligence, men who are capable of handling any branch of agriculture that their fancy happens to take or that the market conditions would warrant, take a position of that sort. A man walked into my office a few days ago, as he has done now for five years in succession, either at Thanksgiving or Christmas time, and laid down on my desk an outline, a financial statement of his poultry enterprise, — a city man with a city wife, who had wanted to get away from the worries of city life, and, having enough means, bought a farm and went into the keeping of poultry. When I saw them branch out into the poultry business I had some misgivings because so many persons have gone into the breeding of poultry who have spent money unwisely and have made failures which have reflected upon the business generally. But at the end of the year, when they came to the college again and showed me the number of eggs they bought, the number of chickens they hatched, the number of eggs they had received in a year and other items of expense, all accounted for, I found they had made the best record of anybody who had ever laid down their accounts before us, and they continued to do it every year right straight along; they have not met their failure yet. This year they reared 94 per cent. of all the chickens hatched, and they have not reared less than 92½ per cent. in the years they have been in the business. They had an average egg production of 133 eggs per hen and 165 eggs per pullet, this past year, for their entire thousand birds.

This man showed me where he had made $2.81 net profit for every one of those hens as his labor income, after paying the interest on the investment and every cost, including labor that they hired, and had made a profit this year of $2,700 and some odd cents from his chickens.

Is he going to keep 2,000 and make twice as much? No. He is well satisfied to keep what he has and take perfect care

of everything he has and make the maximum income per individual. Now, it would take several days to discuss the factors that entered into that man's success, but one of the things that I think has been paramount in his success was the fact that he knew good stock when he saw it, and has bred and handled his fowls with respect to the efficiency of the individual; and that is my text to-day.

Breeding.

With all due respect to the importance of every other important thing in handling poultry, — the feeding, the housing, the incubating, the brooding, the marketing, which are big, strong, important connecting links, — I must say that I feel positive that there is one link that must be stronger than all of the others, and that is the breeding of our poultry. Why? Because everything depends upon the efficiency of the birds that we are handling. If the birds are not what they should be as regards vigor and productivity and productive power, — production of fertile and hatchable eggs and eggs of high quality, — if they are not capable of making use of all of the other factors that we may supply we never can get our reward. Poor hens will not pay in any kind of a system of housing or upon any rations or by any methods of incubation or brooding, nor can we reap our reward by any system of marketing. On the other hand, if we have good, efficient machines to utilize this food, to utilize these buildings and the other facilities that we can provide, frequently a man will succeed if he has not done some of the other things as well as he should, because the birds have been able to manufacture products economically. So I emphasize that we must begin with the foundation principle, that, whatever else happens, we must have the very best stock that it is possible for us to breed and handle. This is particularly true now, when the high cost of feed makes it absolutely certain that a man cannot make money unless he has got good birds, and makes it absolutely sure that he is going to lose money if he has inefficient birds. There is only one blessing coming out of a high food cost situation, as I see it, except to the man who is selling the feed or growing the feed,

and that is the fact that it is going to force people to cut down the number of birds they have got on their farm and keep only the good ones. If it accomplishes this purpose it is going to mean almost a revival of the profitableness of the poultry business.

Another factor looking in the same direction is the high cost of labor, and you people in Massachusetts know better than we do over in New York what it means to compete with the munition factories and other mercantile concerns that are pulling labor from your farms. This means that we must reduce to the lowest number the birds we have, and every one must be a good one, and then increase them as rapidly as we can up to the full capacity, every one a good one. Our objects in breeding should, first of all, be to secure birds that will live, — birds that will have high vitality and will live with us for many years. The greatest weakness of our business is the fact that the bird is a short-lived individual, comparatively; that she is a small individual as compared to other kinds of live stock; and therefore it becomes important that we breed our birds in such a way that we are not going to lose even 3, 5 or 10 per cent. mortality or more per year and have to replace them. It means that when we find a good bird we must be able to keep it for a period of several years for breeding, to establish that factor of a long-lived race. It means that we must have birds that inherit a tendency to produce, an inborn tendency to lay or to grow meat, and to do this better than the average. It means that we must breed those birds to produce a high-quality egg, because the quality of an egg as to its size, color and shape, as well as the number of eggs she lays, is going to measure the money-earning power of the bird. It means that we must breed those birds so that they are going to lay their eggs when they will give us the highest price rather than mere numbers of eggs or quality of eggs. So we have a number of factors there, including also fertile and hatchable eggs, coupled with constitutional vigor, in order that we may reproduce our flocks and get as good or better every year. Those are the main cornerstones of our breeding program.

Now, coming to specific problems, the next step is that we shall have an ideal; that we shall know what we are breeding

for; that we shall have clearly fixed in our minds the difference between good birds and poor birds when we see them, and a person can never expect to make progress in the breeding of poultry if he just has blindly the number of eggs that a hen has laid as his guide. He must have pictured in his mind the kind of bird that will make the profit, and when he has got that ideal he will compare every other chicken with that as his standard, and this standard must be high.

Then he must have a definite procedure in breeding, and the next step in that procedure is that he ought to start where the other fellows left off, rather than to begin at the bottom and have to work up. That means that he should start with some good, pure breed, and he ought to start in a small way rather than in a large way, because if he starts in a small way it does not cost him very much to get a few good individuals, and by waiting a year or two to get his full capacity he will grow and produce from these few and sell them to himself at high prices instead of undertaking to buy himself into the chicken business. Now you will notice that the people who usually fail are the people who have a lot of money and little experience to begin with, and they nearly always undertake to buy themselves into the chicken business from somebody else instead of growing into the chicken business by their own efforts in hatching and rearing and breeding.

Having decided upon our breed, be it Plymouth Rock, Leghorn, Rhode Island Red, or whatever it may be, how shall we know a good bird from a poor one, male or female, when we see them? Now the last word has not yet been said on this subject, but enough has been known and discovered in the past few years so that we are able to tell, with most sensational accuracy, good birds from poor birds when we see them as regards their productive power; and to do this so early in their lives that we can eliminate the poor ones and keep the good ones for the next several years of their profitable lives I want to try to point out to you the differences in at least four or five characteristics between good and poor birds. Fortunately for us there are certain physiological changes, certain external characteristics in our birds, because of their nature, that vary from time to time during the year, and if we understand why

they have occurred and what caused them we will be able to have an insight into the meaning of the thing so that we can read on the outside of the bird what is going to take place on the inside of the bird.

This means that to-day we have a means of improving the quality of our poultry that has never been known before in the ages, and is making it possible for us to now breed our birds as intelligently and as scientifically, nearly, as the man can who has larger kinds of live stock. The great difficulty that the poultryman has had to confront in all these ages, and the thing that has held back the advancement of poultry breeding throughout the country more than any other one thing or all others put together, has been the fact that it has been necessary for us to breed our fowls with regard to their production by flock methods and by flock averages rather than by individual merit. What I mean by that is this, that when a man has $100 invested in hens he has about 100 hens; when he has $100 invested in cows he has only one or two individuals; he can mark and he can know the parentage and the offspring of his cattle, of his sheep, of his horses and of his hogs, but not of his hens. He has known a certain male with a flock, and he has only known that the chickens came from any one of 15 or 20 females, because he has not been able to connect the responsibility for high production or low production with both parents or either parent, and as a result the continuous breeding sometimes of a low line with a high line has held us to averages, and it has only been a gradual and very slow process upward. But with this discovery of certain externals which give us an idea of what is happening inside, we are able to winnow out the good birds from the bad. We can do this without the laborious expense of a daily trap nesting, which has been practically prohibitive because of the fact that it costs in the neighborhood of 50 to 75 cents a year per hen, and it is only here and there that a person has been venturesome enough to undertake the expense and to keep it up. With this method that I am going to try and make clear to you, we only need the trap nest during the months of September, October, November and December, if we have hatched at the proper time; and as a matter of fact, for the use of many farmers and poultrymen it is not

absolutely necessary to have the trap nest at all, as we can certainly make rapid progress by merely judging the birds on their externals. We must realize, of course, that no physical examination of any individual, be it a race horse or a cow or a hog or a sheep or a hen, will always be absolutely correct in predicting the best or the poorest individual, but it will be sufficiently accurate so that, for all practical purposes, a man can eliminate from his flock the unprofitable birds and can keep only the profitable, and can also distinguish between the more and the less profitable.

Points in Selection.

I am going to pass very rapidly over the first step in the selection; after having decided upon our pure breed, it is to recognize those characteristics that indicate the vitality of our offspring or of our stock. We must have good stock to begin with, — strong, healthy, vigorous stock. It is an inherited characteristic to be born weak or strong, and occasionally a bird that is born strong becomes weak by misuse, but whatever the cause may be, it is important that we get rid of any bird that shows weakness at any time in its life from a baby chick up.

As regards the general body shape of a weak chicken you will find that the body usually lacks capacity where there is low vitality; that it has a very tucked-up and rather contracted abdomen; it has a tendency to be hollow-breasted, angular, ungainly and loose-jointed in its make-up. Whenever an individual becomes weak while growing, nature seems to direct its growth towards the enlargement of certain parts and the dwarfing of others. If any part of a weak chicken grows it is its head and beak and feet, and occasionally its wings, at the expense of its body. So you will find a tendency to a rather thin head; a long, thin, flat beak; a rather long, thin neck; thin body; long, thin shanks, legs and toes, and a very poor development of plumage; a sunken, dull eye; a drooping eyelid; a small, pale comb, — all of those external characteristics that indicate poor health, low vitality and a poor appetite. In other words, the bird of low vitality has a weak development of the

breast and a poor development of the abdomen, whereas the strong-vitality bird is strong in those points. Now, if you would compare each of those birds with a triangle you would see that the weak bird, because of its shape, has a tendency to narrow at the shanks, whereas the strong bird has less of a tendency to the triangular form. We say, therefore, that, comparing each of the breeds, of course according to its type, with individuals within that breed the birds of high vitality are those that more nearly approach the parallelogram form than the triangular form, and this is as true of baby chicks as it is of mature fowls, either male or female. If one will get those points fixed in his mind he will be able, with a great deal of accuracy, to eliminate early in the season all of the low-vitality chickens in his flock, sell them alive at whatever he can get for them, and keep only the stronger and more robust individuals in his flock. A person ought to select early in the development of his chickens a few of the strongest, most rapid growing, best birds for future use as breeders, because occasionally birds that do not grow well during the early part of their lives, after they once get well feathered out are more difficult to detect than they are at early stages in their development.

At the college plant last year we selected three lots of white Leghorn cockerels on the basis of the characteristics which I have pointed out. Then we started a series of observations to find out whether there was any difference in the actual breeding value of these three groups, and so they were placed in pens of hens. We had a bunch of 43 white Leghorn hens in pens, and men were stationed in those pens for regular hours during the day. The males were colored with different diamond dyes and the females were marked with different colored paints on their wings, with marks and numbers, and the actual number of matings that took place was recorded to see what the difference in the efficiency of these birds was, based on external characteristics in selection.

This shows that a man must be as discriminating in the selection of his males as he would expect to be in selecting his females, with regard to vigor and productive power, and just because of the fact that you can be more discriminating with your males makes it all the more important why a person

should be. Out of 100 males that a man produces he can eliminate and sell all but about two or three, or four or five; in other words, he has got 95 per cent. more selecting power to get good ones and only good ones, whereas with the hens he cannot reduce them to that extent. He has to keep about 15 to 20 hens for every one male that he has selected; therefore he can be more particular about the quality of his males than of his females. I do not know anything that is more inspiring, I do not know anything that is more worth while, or anything that will tie a man to his business better than to get right into the flock and study those chickens and reduce them by a process of elimination each day or each week as the time comes to sell, throwing out the undesirables until, in the fall of the year, he has a choice bunch of cockerels that money could not buy. And I want to say right here that if a person has not got the love for the business and the love for the stock that will lead him to go in there and help to pick out those birds to fit that ideal that he has established, he never can hope to succeed in the poultry business.

The next step in the selection for breeding is to get uniformity as nearly as possible in the stock that we rear, as regards eggs. We have been making quite a good many studies of the effect of time of hatching on the ultimate producing power of the birds, and you would be surprised to see how such an apparently unimportant matter as a few weeks in the time of the year when the chickens are hatched will affect their ultimate productive value. In other words, it is not simply a question of knowing from which hen or which male our chickens come; it is also a question of knowing when we use those eggs for hatching, — whether it is in March or in April or in May or in June, or earlier or later. And would you believe that, taking the same hens absolutely and hatching their eggs from February on through to July, you get an entirely different result in the laying of those birds for the first year, and frequently also in the next years, due not to the hens or the males, but just to the time you hatched them. A man has no right, therefore, to expect to get the best results until he has learned for himself, with his own breed and in his own section of the country, as to when he should hatch, and that will depend upon the

altitude and latitude and the kind of breed he has. Some breeds develop more rapidly and some less rapidly than others. At the college farm we made observations on three different hatches, — one early, one medium and one late. Whenever a bird began to lay, a mark was placed in the square opposite her leg-band number, and this was continued every day straight throughout the three hundred and sixty-five days that followed the beginning of the observations early in November. About two weeks after the first hatch began to lay the first individual in the second hatch commenced, and about two or three weeks after the second hatch began to lay the third hatch commenced, and by the time the first hatch had all begun to lay nearly all of the second hatch, but not all, had commenced to lay, and in the course of two or three weeks more all of the third hatch had commenced to lay. In other words, the chickens hatched two or three weeks apart in the spring began to lay two or three weeks apart later on in the fall, and so there was a succession of eggs from each of the hatches coming on in about the same proportion as the difference in the time that they were hatched. In other words, we have a new crop of pullets coming on to lay, giving us a new lot of eggs, and these birds that were hatched very late, and therefore did not begin to lay until very late in the fall, had a little tendency to make it up the following spring by laying a little at that particular time when they once got under way, but they did not make up their lost time, and they could not possibly ever make up the handicap in money value that these pullets of the first hatch and the second hatch made by laying eggs in November and December, when they were so scarce and so high.

Our recommendation naturally is that the policy ought to be to have the pullets hatched at such a time that they will lay the most eggs in the first year, and give us the largest possible number in periods of high prices, and we have worked out that for Leghorns in central New York, under our methods of feeding and rearing and handling, there is a time when we can get our largest net yield from those birds, and that is between the 15th of April and the 15th of May. In that length of time we should hatch the bulk of our Leghorns and Rhode Island Reds. With Plymouth Rocks that season ought to be probably just a

little bit earlier, because they are a little slower to develop, and the principle involved is this, apparently, that we need to hatch the pullets at such a time in the spring that they can be reared in cool weather; that we can get maximum fertility and hatching power; that they can get their start and get well feathered before the very hot weather comes on; and that they can reach the laying age, which is about six to eight months, so that the first pullets that lay shall be in their winter quarters and comfortable, and flocked and at home and contented before they lay and before cold weather hits them. If we get that combination they begin to lay in the fall and go through with scarcely an evidence of moult, and give us our largest maximum yield the first year, and are likely to go along and do the same thing for two or three years.

If, however, we have hatched them too early in the spring, then they lay too early in the summer, moult before the fall weather comes on, and they do not give us good production at that time. If we hatch too late, in June, for example, or later, they do not get their full pullet plumages in time to get well feathered and ready for laying in the winter, and they do not lay until towards spring. But what we ought to do is to be medium in this matter; get the bulk of our chickens at the time they will do the best for us, and then hatch a few perhaps a little earlier in order that they may give us eggs before the other pullets have begun and after the hens have mostly ceased; that will enable us to hold up our production, even though we know that they are not going to lay well later in the winter. There is another reason why it is important that we know something about the ages of our birds, and I think we ought to identify them, if possible, either by putting the pullets that are hatched at one time off in certain houses, or marking them so that we will know, in the fall of the year, at what particular time they were hatched.

It is well to hatch a good many at once, anyhow, not only to make it easier work to take care of them, but to be able in the fall to approximately identify them as to age, and you will see the significance of that in what follows. A pen of birds that were hatched on May 2 laid us 140 eggs the first year; those that were hatched on May 20, 142; those that

were hatched on May 31, 118. We can expect to get our highest fall yield from pullets rather than from hens, and each year, as long as the hens live, they have a tendency to begin later and later in the fall to lay, and then to cease earlier and earlier the following summer, shortening the length of their laying year. Ultimately we find that hens, as they grow older, up to seven years or more, as we have them at the present time in our flocks, have a tendency to lay less and less eggs in the months of difficult production, — of cold weather, — and whatever eggs they do lay, to lay them in the months that are most favorable, — the months of April and May, — and I predict that when these birds have reached ten, twelve or fifteen years or more of age, as some of them undoubtedly will, the only eggs they lay at that time will be in the months of the natural breeding season, — April and May. The pullets lay heavily in the months of cold weather as compared to the production of the same bird in other years, and the tendency for the third year is to shrink away in the fall of the year. And yet all, whether they are hens or pullets, have a tendency to lay about the same number of eggs in the months of May and June.

Now the last step in our program is the matter of selecting our hens with regard to productive power by means of the way in which their external characteristics change throughout the year. The only way we can really understand the philosophy of this thing is to study the inside of a hen as well as the outside, to see what the relation of the characteristics is. Now, the hen lays her eggs according to a certain law of physical development. It is the perfectly natural, normal thing for a pullet to reach the age of sexual development and production at about six to eight months of age. Sometimes they develop abnormally early and are precocious, and then pullets have been known to lay when they were four months of age. I have had hens myself which laid at four months and four days. Sometimes they do not lay until they are nine or ten months old, and we have one hen that did not lay until she was three years old. She only laid three eggs that year, yet she strutted around and made out that she was quite as good as any of the rest of them; she was one of the modern

aristocrats. Tests in the development of the oviduct and ovaries of chickens show that at three months old the oviduct is not more than 4 or 5 inches long, but the development is so rapid that at six months of age, when the pullet is not quite ready to lay but approaching it, there is an oviduct that is a foot and a half long and an ovary that shows yolks of the eggs that are the size of pennies, nearly the size ready to lay. At seven months the hen has taken on the appearance of full maturity in depth of body, size of tail and wings.

When a pullet is eighteen months old, just prior to the close of the laying period, she will begin to go back; her comb becomes smaller and paler; the wattles have shrunk up, her abdomen is contracted; she has not as full a crop and she does not have the activity. She is not as friendly. The pullet that is laying heavily is friendly; the pullet that is dormant is likely to be wild; and you will notice that as you study your birds about you in the pen as well as the change in their shape.

At the close of the first laying season the oviduct is not over 8 or 10 inches long, possibly a foot, whereas only a month or so before, when she was in full laying, that oviduct, without the egg being in it at all, would be 2 or $2\frac{1}{2}$ feet long and greatly congested. In other words, the reproductive system of the hen changes inside of the hen each month of the year as she is productive or dormant, just the same as the udder of a cow is congested and full and large and active when functioning, or shrunken and inactive when she is not productive. Now this change of the reproductive system inside of a hen changes her shape. When this is large and full her abdomen is deep, and when she is laying she is eating a good deal of food and her crop is nearly always full, so that when she is active and laying she is in her best physical condition, and usually carries a good deal of surplus fat in her body; whereas the pullet or hen that is dormant usually has little fat, and the reproductive system is shrunken to its smallest size. We find, also, that whenever the reproductive system is active the external characteristics, the secondary sexual characteristics, the comb and the wattles and the ear lobes all change in accordance with the change that takes place inside; so much so that we can tell

by the texture of that comb, by the way it feels, whether a hen is laying or not, with great accuracy, just because of the sympathetic development of these two functions, — the reproductive system in correlation with these external characteristics.

The hen that is in full moult is still more dormant than the other, ragged in plumage, dry in comb and with pale shanks, and she is in a physical condition of dilapidation, and so for at least three months of her life. That is not always the case with all hens; some hens have so much vitality that they go right on laying during their moult; others cease laying when they begin their moult. When the hen has moulted and begun to lay again her body is taking its new shape of activity and development of the deep abdomen; she has a different carriage, larger comb, brighter color and is now functioning again.

Now that discussion will perhaps serve the purpose of paving the way to a careful, systematic classification of these characteristics of the birds. There are four characteristics that we look for in the birds to judge of their productive power. The first is the texture of the comb; the color is worth something, but it is not as valuable as the texture. The size is indicative of productive power, but it is not as important as texture. Mr. Kent, one of our instructors, discovered this fact a few years ago in making his studies of the birds; that the feeling of the comb, as to whether it is dry and hard or whether it is warm and pliable and velvety and soft, indicates whether a hen is laying or not at the time the observation is made, and so we take five degrees of variation. No. 1 is oily and soft; that indicates that a hen is in a laying condition. No. 2 is very pliable; she may be just getting ready to lay or may have ceased laying for a little while. No. 3 is slightly pliable; this stage indicates that it is about halfway between the very soft, pliable comb of a laying hen and the dry, hard comb of a dormant hen. Then we have No. 4, quite hard, and No. 5, dry, hard and stiff, in the case of the dormant, moulting hen.

The second characteristic is that of the color of the shanks, and in the case of any of the breeds that normally have yellow shanks, — the Plymouth Rocks, Wyandottes and Leghorns, — when the hen is in full health and functioning, then we know

that that color changes quite remarkably as to whether she has laid many or few eggs. By noting the degree of change in color of those shanks we can estimate quite accurately the productive power. There are five degrees in this change of color, — pink or white, cream color, lemon, light orange and orange, — so that when a hen of any of these breeds has been dormant for any length of time the color or pigment comes back until they are full color; whereas, if she has been laying a long while and has laid many eggs she has laid that color out.

The third characteristic is the color of the ear lobe. The Connecticut Experiment Station a few years ago discovered the fact that by noting the appearance and disappearance of color pigment in the white ear lobe of varieties of fowls that have that colored ear lobe, they could estimate whether or not a hen was laying, and, in a degree, how many eggs she had laid in a year, if observations were made at the right time. We have noted that characteristic among our four, and we classify each bird as to whether she has enameled white ear lobes, and if she does she is put down as No. 1; light cream color, No. 2; light lemon, No. 3; lemon, No. 4; light orange, No. 5; and this is so reliable in the case of pullets that if you go into a flock of Leghorn pullets and notice the color of the ear lobe alone, you can tell with surprising accuracy whether this pullet has laid a few eggs, or is just going to begin to lay, or has laid many eggs, or has not laid any eggs at all.

The last characteristic is the moulting characteristic, as to how a hen moults, particularly when she moults. We have defined five degrees of moulting. Go into any flock of hens and pick them out and undertake to score them on their moulting characteristics and you will find one hen that has not moulted at all, and another that is all through moulting, and then there will be gradations between those two which we have classified as follows: No. 1 is the bird that has not moulted at all; that indicates that she is still laying. No. 2, new body feathers 1 inch long indicate that she is starting to moult. No. 3, new body feathers 3 inches long indicate that she has started to moult still more heavily. No. 4, moulting nearly complete, and for a complete moult, No. 5.

Now, if a person will pick up a bird and score the bird according to the comb texture, the shank color, the ear lobe color and the moulting condition, without ever trap nesting his birds at all, and do this at the right time of the year, — in the months of September or October or November, when the bird is susceptible to all these climatic changes that cause her to cease to lay, and when only the good hens will lay, — he will be able to pick out and eliminate from his flock the low-producing birds with surprising accuracy. He can then keep the high-producing birds and classify them in those three groups, as I will show you from the figures that are to follow. I wanted, however, to get this point clear in your mind, so that you can go home and put this thing into practice, if you care to. Now remember that in scoring these birds the lower the score the bird gets the better she is; the higher the score she gets the poorer she is. Whenever you score a bird with those four characteristics, the highest possible score you could get would be 5 in each one of these, which would be 20; the lowest possible score would be 4; she would be 1 in comb texture, 1 in shank color, — that is to say, she would have 1 in comb texture, a very bright red and a pliable, soft comb; she would have 1 in pink or white shanks, indicating that she had laid for a long while and was still laying; if she had ceased to lay the color would have begun to have come back in her shanks again. An enameled-white ear lobe will count one, and if she has all her old feathers that also will count one. That score will show she is a high-producing bird. If, on the other hand, she had a very hard, dry comb, 5; orange-colored shanks, 5; if she had yellow ear lobes, 5; if she had completed her moult and had all new plumage, 5; you could put that hen down absolutely as a very, very low-producing hen.

To prove to you that this method of scoring birds works out in practice, I will give you the figures on three lots of Leghorn yearlings at the college farm which we scored in this way. We had trap-nest experiments on several hundred birds, and we picked out the twelve highest, the twelve medium and the twelve lowest producing birds, according to our office records. Now the egg records of these birds were 210, 207, 199, 198, 188, 188, 200, 208, 188, 193, 188 and 179; and on the points I

have given you, — namely, comb texture, shank color, ear lobe color and moult, using the figure 1 for the best score on each point and the figure 5 for the poorest, — their scores ran along around 4 or 5, with only one bird scoring as high as 7. You see those were all excellent scores, and the egg records show they were excellent birds.

The egg records of the twelve medium birds were 136, 134, 133, 128, 127, 125, 122, 122, 120, 113, 111 and 110, and their score on those four characteristics was 6, 11, 6, 13, 9, 10, 13, 8, 7, 8, 6 and 12.

The egg records of the twelve low birds were 66, 59, 54, 52, 52, 50, 50, 41, 34, 2 and 0. Their scores were 14, 18, 14, 17, 14, 15, 10, 15, 16, 13 and 12.

You see that high egg records and low scores, medium egg records and medium scores, low egg records and high scores go together pretty consistently.

Now suppose a person agrees to go into his flocks at certain times of the year and select these birds with regard to the time they begin to lay and the time they cease to lay, as indicative of their productive power, using those characteristics that I have already pointed out to help him pick out the birds to see whether they are laying or not. Now I want you to get this thing clear, — that you do not have to observe these birds the year round; but if you will only observe the pullets during the fall months to see when they lay the first egg, and mark them, you will never need to observe that pullet again. You do not have to put the record down whether that pullet laid any time during the season after you have once put a band on her leg to know that she has laid in the fall. That is all you want to know. That is not a difficult thing to do. A person can do it by those characteristics that I have stated, with a great deal of accuracy, or, by putting trap nests and trapping them for that short length of time, can find out the age that the pullets are when they lay their first egg; and then the following fall, when these birds cease to lay, put down on your bird, with another leg band, the fact that they were laying or were not laying at a certain time in those same months, in the fall of the year. Now those months are September, October, November and December; and we have now come to the real-

ization of what I believe is the most important clue to the hen's productive power, namely, the length of her laying period, determined by the knowledge of the date she laid her first egg and the date she laid her last egg in her first laying year. By that knowledge you can predict not only what a hen has laid during the year, with great accuracy, but you can predict what she is likely to lay in the next two or three years, under ordinary care. In other words, let me express it in this manner: you have heard the statement made over and over, "Tell me the company a man keeps and I will tell you who he is." "Tell me what a nation eats, and I will tell you who they are." Now we are going to paraphrase that and say, "Tell us the date that a pullet laid her first egg as a pullet and the date she laid her last egg in her pullet year, and we will tell you how many eggs she has laid that year, and how many eggs she is likely to lay if we keep her for several years."

It would not be safe for us to depend entirely on early laying as a guide in selecting our birds, because if we do so we include a good many birds that may have laid prematurely and will not be able to stand up under the heavy production for a period of years, and therefore we need to know when they cease to lay as well as when they commence to lay.

We have kept figures on some of our Cornell birds as to when they ceased laying, with the following results: of a group of 168 birds, 4 ceased to lay before July 1, and they laid 84 eggs; 17 ceased to lay by August 1, and they laid 96 eggs; 52 ceased before September 1, and they laid 117 eggs; 39 ceased before October 1, and laid 142 eggs; 39 ceased before November 1, and laid 166 eggs; 14 ceased before December 1, and laid 182 eggs; 3 ceased after December 1, and laid 189 eggs. Notice how many more eggs are laid by those groups that continue to lay late as compared to those that ceased early.

If a person had marked his birds so that he knew by putting a band on the left shank that these birds had all begun to lay as pullets, and had laid their first egg before they were eight months of age, he would have been able to keep the high-producing birds and discard the low producers. If he also knew, by marking his birds, those birds that laid some time after the first of September, he would have a choice group of

birds, all indicated by the fact that they had a leg band on the left shank because they began by the time they were eight months old, the leg band on the right shank showing that they laid after September 1.

Birds can be classified into four groups, first, those birds that lay by the time they are eight months old and also continue to lay until after September 1, and so have leg bands on both shanks. The second group will be those birds that begin before they are eight months old, and they get a leg band on their left shank, but they cease to lay before September 1 and get no leg band on their right shank. Then we have a third group that are slow to begin to lay, and therefore do not get a leg band on the left shank, but do lay after September 1 and get one on the right shank. Then we have a fourth group of birds that do not begin to lay until after eight months and get no leg band on the left shank, and ceased to lay before September 1 and therefore have no band on the right shank.

By that method of selection we picked 81 birds out of 166 that had leg bands on both shanks, or 48 per cent. of the flock; 44 birds that had leg bands on the left shank only, or 26 per cent.; 13 that had leg bands on the right shank only, or 7.8 per cent.; 28 birds that had no leg bands on, or 16.8 per cent. The first group's production was 166 eggs; second group, 122, — a difference of 44 eggs per hen for the group; the third group, 114 eggs; the fourth group, 90 eggs. In the second year the first group laid 140, the second group, 107, — a difference of 33 eggs; the third group, 129; the fourth group, 107. The record for the third year was 123 for the first group, 95 for the second, 114 for the third, 95 for the fourth group. The average production of three years was 143 for the first group, 108 for the second group, 119 for the third and 97 for the fourth.

And what did this mean in money value? It meant that the eggs sold at commercial prices for the first group averaged to sell for $3.57 per hen per year for three years; the second group, $2.40 per hen; the third group, $2.87 per hen; and the fourth group, $2.18 per hen. How is that for a contrast between the $2.18 and the $3.57 actual money value per bird for those years?

The first laying year for the first group comprised a 303 days' span between the first and last egg; the second group, 245 days'; the third group, 211; and the fourth group, 178. Notice the difference in the length of the laying period. So what would we have accomplished if we had, by this simple method of leg banding, been able to discard 28 birds at the end of the first year as birds that had an average production of 90 eggs the first year, 107 the second, and 95 the third, — an average of 97 eggs for the three years.

These birds were all culls, every one of them. Every one of them lost money for us if we kept them, and if we had wanted to we could have thrown all those birds out at the end of the first fall, or we could have kept them until early spring, when they ceased laying, and let them go at that time. We could have thrown away or could have sold as mere layers both of these groups, and we would not have lost any of our very high-producing birds, and we would have kept all, — practically all, — of our high-producing birds.

Now here comes the practical application of this thing to a color system of leg banding. I want to explain it to you in order that you may get the point clearly, and that is that we have first of all a record of the age of a bird, and then we have in the henhouse a statement when the birds in that house are six months old, when they are seven months, eight months, nine months old, and so on. It is a very easy matter to figure out; you can do it in five minutes on the calendar. Knowing the date they were hatched, have hung right over each of those dates, nailed on, a certain leg band. Let each leg band be of different color; ordinary celluloid bands are used. Then mark those pullets as you see they are laying, either by trap nests or by means of external characteristics that you put on the shank of the bird. For the one that begins to lay before she is six months of age a blue leg band on the left shank; blue bands indicate best quality birds. Any bird that lays between six and seven months, put a red band on the same shank. Any bird that lays between seven and eight months, put a green leg band on the left shank, and on those that lay between eight and nine months put a yellow leg band on the left shank. After they are nine months old a person

does not need to observe them any more; that will be somewhere around the 1st of January or the 1st of February, depending upon how early they were hatched. Any time a person goes into that pen and sees these birds running around he can see instantly what class they fall into by the color of the leg band, but he does not want to stop with that test, as you have seen from the statement and records given you, and I will show you why in a few minutes. Now, suppose he does that and he finds that 4 of them get blue, 71 get red, 50 get green, 22 get yellow and 19 get no bands at all, or perhaps black might be a good color for them, because that stands for mourning, meaning they have got to die, — practically no good. Suppose now we wait until the fall of the year, and if the pullets cease to lay by September 1 the chances are that they are not very good. Birds that began prematurely early to lay, and who ceased to lay a little before the 1st of September, get a yellow leg band on the right shank — a yellow leg band — because they ceased to lay before September 1. In the fall of the year we reverse the process, and the quality always goes with the length of the laying period, so that we begin by using the yellow band for those that ceased before September 1, the green band for those that ceased before October, the red before November and the blue before December. Then we have the birds with the leg bands on the right shank and the left, or with the left only and not the right, and it may be of one color or the other. So we can tell as the birds run around, after spring and fall testing, in which group they belong; and here you can see what the difference in the value of these birds is. Of the 71 birds 22 of them ceased before September 1, 18 between September and October, 22 between October and November and 9 after the 1st of November, making the 71. The birds with the blue leg band average 230, 195, 161, 171 eggs, even though they have been rather late layers, sometimes showing that the lateness which hens continue to lay is a more valuable indication of their productive power, even, than the earliness that they lay as pullets; and not only is this shown in the number of eggs that they lay, but also in the dollars' worth of eggs they lay, figuring up the egg values at the prices which are

true here, no doubt, as they are in New York State, the wholesale price being 45 cents for January, 34 cents for February, 23 cents for March, 23 cents for April, 23 cents for May, 25 cents for June, 29 cents for July, 34 cents for August, etc. The values of the eggs of those early layers were $4.08; those that were hatched between six and seven months, $4.12; those that laid at seven to eight months, $4.29; those that laid between eight and nine months, $2.49; and the 19 birds that did not lay until after nine months, $1.93. Now coming clear over to the three-year record you will find that the birds that began early laid 145 eggs; those that began next, 125; then 123, 112 and 95, and the values of these eggs were $3.64, $3.34, $2.84, $2.15.

Now, suppose we make a rule that Leghorns hatched in the middle of April or early May, and which do not lay by the time they are eight months old, shall get a leg band on the left shank, and those that continue to lay after September 1 get a leg band on the right shank. After studying all these birds in all these different combinations we find that this is the one best rule to go by with Leghorns, and if you do that you will not lose very many good birds. Now, by doing that we found that out of 166 birds 81 of them fell into the class of having two leg bands, one on each shank; they began to lay before they were eight months old, and they continued to lay after September 1. Now, get their production, — 166 eggs. Eighty-one birds out of 166 average 166 eggs per year. Forty-four birds fall into the class of laying before eight months, but ceasing before September 1; they get a leg band only on the left shank. They laid 122 eggs as against 166. Thirteen birds fall into the class of beginning to lay after eight months, but continuing to lay after September 1. They get a leg band on the right shank only. See what they laid, — 114 eggs. Then there are 28 birds that get no leg bands; they began after eight months and they ceased before September 1; they had a very short laying period, so they get no leg bands. They averaged 90 eggs.

A Member. I would like to ask you, Professor, in making this test if there was no mortality among those 166 birds?

Professor Rice. The records would naturally be comparable

on the three-year basis. We could not include the record of birds that die. Some birds always die the first year or the second year, and we studied their records very carefully, and we find that as a rule they are likely to be perpetual producers, but occasionally a very low producer dies because of physical exhaustion.

A Member. In making that test do you substitute another bird?

Professor Rice. No, we have never substituted another bird. We carried the same birds through always, and have not taken into consideration any bird that died in the meantime. It would not affect the principle in the least.

A Member. Could these scores be made by physical tests?

Professor Rice. They could all be made by physical tests; as a matter of fact, however, it will pay to use trap nests, especially for persons who want to sell their eggs. For a farmer who is simply anxious to get results he can use physical tests, but to a poultryman who wants to sell eggs on absolute guarantee, and get high prices, it will pay him to put in trap nests and know absolutely the day that a hen began or ceased to lay.

I can only speak in passing of the importance in the quality of eggs in selecting our breeders, and a person can well afford to take the time to go over every egg that he uses for setting. Take a case of 30 dozen eggs and the chances are, if he uses the proper discrimination as to color, shape and size, he would find it a pretty difficult matter to get 50 eggs out of that case absolutely all right in every way. That is true of Leghorns, and I think true of every breed, and the importance of it is that the color pigment and color, shape and size are inherited characteristics, and we need to be exceedingly careful that we do not use an egg that we do not want perpetuated. One big loss is due to the necessity of having to throw out so many eggs that are not up to standard as to color or shape or size. If we can simply follow that practice, however, of using only the choicest eggs for breeding purposes, we will find our birds growing better and better, and we will see that every year our eggs will grade higher and higher. We have a number of people in our State who are doing this thing and have been doing it for many years, and the results are phenomenal in the

improvement of the quality of the eggs. This is not a new thing to us at all. One year our extension men selected 29,000 hens for breeders. We have case after case in our State of men who will vouch for the fact that our men have gone into their flocks and picked out 200 or 300 hens, and they never got a laying hen out of the bunch, and these were sent off to market or put in other pens and kept there for a while. We have a case near by where Mr. Krum went up and picked some 200 or 300 birds out of about 700 or 800, and the man kept the balance, about 500 in all, the next year, and also carried over about 700 pullets, and that man tells us that he got a higher production the next year from those choice 500 hens that Mr. Krum picked out than he had gotten from the total population during the first year, and more than he got from his pullets. That means that by picking the hens out according to these tests, as I have showed you we could easily do, you can get rid of the non-producers and keep only producers.

As regards this matter of late moulting, I had the experience of speaking at a poultry association at Auburn two or three years ago, and after the lecture was over they said to me, "Come on out now, right into the farmyard and pick out the birds." Well, the farmyard was right there and that is just what we wanted to do, so we all went out together, and I picked out a dozen or 18 hens — this was in the latter part of September — every one of whom I knew was a bird who was laying about 175 or 200 eggs a year, and one of the men spoke up and said, "Why is it you are always picking out those dirty hens?" Well, as a matter of fact, I had not noticed that I was picking out the dirty hens. I was picking out hens that had not moulted; hens that had pale shanks; hens that had full crops; hens that had soft, velvety combs. I had not thought about the dirt on them, and the proprietor spoke up and said, "I can explain that to you. I put disinfectant in the nests — sprayed my nests with disinfectant only a week or so ago, and the only hens that are colored up as you see them here are the hens that are laying." So those high-producing hens, laying late into the fall, had this color or spray on their plumage, and they were the ones that had marked themselves. And you will find it will work out every time.

One of our young men down in New Jersey the other day at a poultry exhibition picked out the two highest Plymouth Rocks in an egg-laying contest, just by looking at them. Now, we are not guessing at this thing at all. Any man with his eyes open and who knows what he is looking at will be able to do that same thing, and do it with the most surprising accuracy.

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THE MAINTENANCE OF SOIL FERTILITY.

CHARLES E. THORNE.

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THE MAINTENANCE OF SOIL FERTILITY.

C. E. THORNE, M.S.A., DIRECTOR, OHIO AGRICULTURAL EXPERIMENT STATION, WOOSTER, OHIO.

The Pioneer Farmer.

Two centuries after the Pilgrim's axe had attacked the primeval forests of eastern Massachusetts, the Pioneer's axe began its similar work in eastern and southern Ohio. In both States alike the first task of the farmer was to clear away the encumbering forest from a little patch of land on which he might grow corn and wheat to feed his family and his animals. With the same crude implements of husbandry which had been in use since man first began to till the soil, both the Pilgrim and the Pioneer laboriously tilled their little fields; both scattered their seed grain by hand, as did the sower of the parable; both harvested it with a sickle like that used in Moab's fields; and both threshed the crop with the flail or by trampling it out with animals, as did that farmer thirty centuries before.

When larger fields were needed more trees were cut down and split into fence rails or burnt in log-heaps on the land, and when the fields first cleared began to show diminishing yields under the superficial husbandry of the day they were turned out to recuperate in weeds and briers, and new clearings were made. Such "worn-out" fields I have seen in Ohio, abandoned after less than half a century's cultivation.

With the gradual increase of urban population, and with the growth of foreign commerce, wheat became a more and more important crop, and in Ohio it became the principal cash crop. The gradually developing avenues of transportation, first by lake and river, later by canal, and finally by numerous lines of transcontinental railway, together with a soil and climate exceptionally adapted to the production of this crop, all combined to favor its production.

At the same time, corn held the leading place in both Massachusetts and Ohio because of its unparalleled value as a food

for animals, an acre of corn yielding more potential food than an equivalent acre of any other crop grown in the temperate zones.

But the marvelous growth of the cities in and near Massachusetts during the last half century has necessitated a complete readjustment of the agricultural industry of that State, and the same cause is producing a similar effect in Ohio. No farm product lends itself more readily to transportation than wheat, and none is adapted to a wider range of soil and climate. The center of production of this incomparable bread grain has therefore moved to Kansas, the Dakotas and the Canadian Northwest, while the production of milk and vegetables — products to which long-distance transportation is comparatively unfavorable — is crowding out the wheatfields of the eastern States. Corn may withstand this pressure longer than wheat because of its value for animal food, and wherever milk production is a prominent industry corn will continue to be grown; but recent statistics of crop production show that 25 counties in Ohio are each annually producing more bushels of corn than the entire State of Massachusetts, and each of the 88 Ohio counties is producing more wheat than all of Massachusetts.

The Phosphorus Supply.

The chemist tells us that as the cereal crops mature approximately three-fourths of the phosphorus in the plant is transferred to the grain, while a similar proportion of the potassium remains in the straw and leaves. When grain or hay is fed to live stock the animal abstracts from its food the phosphorus required to build its skeleton, of which phosphorus is one of the leading constituents. We buy bone meal to fertilize our fields for the sake of the phosphorus it carries. If we are feeding for milk production the need for phosphorus is no less urgent, for milk is the natural food of the young animal, and therefore must be abundantly stored with this indispensable element. It follows, therefore, that, whether our system of agriculture have for its chief object the production of grain or of milk, the soil supply of phosphorus will eventually be depleted, relatively to that of potassium, unless some measures be taken to restore the equilibrium.

Twenty-three years ago the Ohio Experiment Station began an experiment in the use of fertilizing materials on crops grown in a five-year rotation of corn, oats, wheat, clover and timothy, on land that had been used for the general production of such crops since its reclamation from the forest seventy years earlier. The next year a duplicate of this experiment was begun on a different soil that had been pastured chiefly by dairy cattle for twenty-five years previously. In 1904 two experiments in the culture of corn, wheat and clover in three-year rotations were begun, the one on a grain farm in southwestern Ohio, the other on a live-stock farm in the hill country of southeastern Ohio, these farms being from 40 to 150 miles apart. The outcome of these tests has been that 100 pounds of 14 per cent acid phosphate, when used alone, has produced an average increase to the value per acre of between $4.09 and $4.85 per acre in each of the four tests, whereas potassium, when used alone or with nitrogen only, has never returned its cost. When potassium has been used with phosphorus, however, there has been a larger gain on the grain farms, both total and net, than that from phosphorus alone, although the potassium remained unprofitable on the dairy farm.

The station has also conducted an experiment in which potatoes, wheat and clover have been grown for twenty-three years in a three-year rotation on land, half of which was cleared from the forest for the purpose of this test, and one in which tobacco, wheat and clover have been grown in rotation for eighteen years, these tests being located in different quarters of the State. In both tests wheat has shown a decided preference for phosphorus over potassium. During the earlier years the potatoes showed a similar preference, but of late phosphorus seems to have largely lost its effect on this crop, while the gain from potassium is steadily increasing. The tobacco crop has not been grown over so long a period as the potatoes, but its preference seems to be for potassium rather than for phosphorus.

The outcome of these experiments is in harmony with those of the Massachusetts Experiment Station, in which truck or similar crops have been largely grown, — crops grown chiefly for their roots or stems and leafy parts rather than for their seeds, and which have shown a larger response to potassium

than to phosphorus in the fertilizer, although even here the best outcome has not been reached unless both phosphorus and potassium were applied.

The lesson from these tests seems to be, therefore, that in respect to these two elements of fertility — phosphorus and potassium — we should study the character and composition of the crop, and especially should remember that neither phosphorus nor potassium is ever wholly absent from any plant, and therefore that the supply of both these elements must be looked after.

It is true that these elements are found in all soils, and apparently in liberal quantity, as compared with the needs of the crop. In the Ohio soils under experiment we find in the upper 7 inches of an acre from 700 to 1,200 pounds of phosphorus, yet it is impossible to grow a full crop of any kind until we add some material containing phosphorus in an easily soluble form. More surprising yet is to find 16 to 18 *tons* of potassium in the same 7-inch acre, and yet so small an application as $8\frac{1}{3}$ pounds of potassium per acre, carried in 20 pounds of muriate of potash, has added 5 bushels of corn to the yield, as a twelve-year average, when added to a dressing of phosphorus.

But what would have happened if the 16 to 18 tons of potassium stored in our soil had been as easily soluble as common salt or muriate of potash? Ages before man came to inhabit the earth the potassium would all have been in the sea. Thus we understand why it is that the great store of potential plant food shown by the chemist to be in the soil may have no practical value for crop production, and why we cannot depend upon chemical analysis as a guide to the use of fertilizers until the chemist shall have discovered some reagent key that will unlock these stores in the same manner as do the vital agencies which are working in the soil. Bryant sang of —

> . . . the sluggish clod
> Which the rude swain turns with his share
> And treads upon. . . .

but we now know that this "sluggish clod" is inhabited by living organisms, infinitely small and infinite in number, upon whose work depends the existence of all living things.

The Nitrogen Supply.

But while the composition of the crop may offer a suggestion as to the balance between the mineral elements of plant food required, the case is different when we come to nitrogen. For example, when we analyze equivalent crops of corn and wheat, as grown under equally favorable conditions of soil and climate, we find that the corn has secured twice as much nitrogen from an acre of land as the wheat; but if we grow the two crops on land of the same character a nitrogenous fertilizer may produce twice as great a proportionate increase in the wheat as in the corn. And while neither of these crops can be grown to perfection on a nitrogen-hungry soil without the addition of some source of nitrogen, a perfect clover crop may be grown on such a soil if only the mineral elements — phosphorus, potassium and especially lime — are provided in available form and in sufficient abundance.

The superior ability of corn over wheat to obtain its nitrogen supply is explained by the fact that the corn crop is grown during the hot months, when the process of nitrification, by which the inert organic nitrogen in the soil is converted into available form through the action of the nitrifying micro-organisms, is most active, while the wheat is grown chiefly during the cooler months; but clover, as is well known, owes its advantage to the action of the bacteria which inhabit the nodules on its roots.

In Broadbalk Field, at the Rothamsted Experimental Station, wheat has been grown continuously since 1843. Starting with an average yield of 17 bushels per acre for the first ten years the yield has fallen to 10 bushels for the ten years 1903–12, averaging 12.6 bushels for the sixty-one years 1852–1912. When a mineral fertilizer, made of 342 pounds acid phosphate, 200 pounds sulphate of potash and 100 pounds each of the sulphates of soda and magnesia, has been used the yield has been 14.5 bushels, a gain for this large dressing of minerals of less than 2 bushels of wheat. When to this dressing of minerals 43 pounds of nitrogen has been added in ammonium salts the average yield has been increased to 23.2 bushels. Doubling the ammonium salts has increased the yield to 32.1 bushels, and

trebling the ammonium salts, to 36.6 bushels, while 16 tons of barnyard manure applied every year has produced 35.2 bushels.

This experiment has demonstrated the possibility of maintaining the largest yield of wheat, considering both amount and duration, of which the world has any record, by the use of chemicals alone, without any addition of organic matter or humus-forming material except the roots and stubble of the wheat itself. But the increased yield of 24 bushels has cost $34, — $8 for the minerals, assuming the sulphates of soda and magnesia to have been unnecessary, and $26 for the nitrogen. Evidently some cheaper source of nitrogen must be found than chemical fertilizers if wheat is to be grown altogether on chemicals. Nor is there much more encouragement for dependence upon manure alone, as it has required 16 tons of manure to produce 23 bushels of wheat.

Crop Rotation.

At the Ohio Experiment Station corn, oats and wheat have each been grown continuously for twenty-three years. Where no fertilizer or manure has been used the yield of corn has fallen from 26 bushels per acre for the first five years to 7½ bushels for the last five years; that of oats from 28 to 20 bushels, and that of wheat from 10 to 7 bushels.

The only treatment which has maintained the yield of the continuously grown corn without reduction has been the annual application of a fertilizer carrying 50 pounds of nitrogen per acre in nitrate of soda, together with 160 pounds of acid phosphate and 100 pounds of muriate of potash, the whole costing over $13 per acre annually. This treatment has maintained an average yield of 46 bushels per acre for twenty-three years, at a cost of about 40 cents for each bushel of increase over the unfertilized yield; but with less than one-half this quantity of the mineral fertilizers, and without any fertilizer nitrogen, corn has been grown on the same land and for the same period in rotation with other crops, including clover, and the yield has been 43½ bushels, costing only 10 cents a bushel for all the fertilizers required to produce a bushel of grain.

Comparing the two systems for the twenty-three years we find that in continuous culture we have produced 1,057 bushels

of corn at a cost of $300 for fertilizers, and in rotation we have produced 959 bushels at a fertilizer cost of $40, so that the extra 100 bushels of corn produced in the continuous cropping has cost $260, or $2.60 per bushel.

The chief difference between rotative and continuous cropping is that in continuous cropping we must furnish all or nearly all the nitrogen required by the crop, whereas in rotative cropping we may secure a large part of this nitrogen through the clover crop without cost.

I have already said that in Broadbalk Field a sixty-one-year average yield of wheat of 36.6 bushels per acre has been maintained by chemical fertilizers alone, but at a cost for fertilizers, including nitrogen, equal to the value of the crop, saying nothing about rental of land, seed and labor.

At the Ohio Experiment Station the same average yield of wheat has been maintained for twenty-three years in a rotation of potatoes, wheat and clover on each of three different tracts of land, and of 37.8 bushels on each of three other tracts, in which the increase of potatoes and clover has more than paid all cost of fertilizing, leaving the increase in wheat as clear gain.

In this experiment the potatoes are grown on clover sod, which seems to furnish all the nitrogen required by the potatoes, but the wheat has been able to use a little more nitrogen than that left over by the crops preceding it. In short, our experiments indicate that clover cannot be expected to furnish much more than enough nitrogen for the crop immediately following it, if the hay is removed and only the roots and stubble are left, and that if more than this is required the entire crop must be plowed under or else nitrogen must be provided from other sources. Under some conditions it may be justifiable to plow under the clover crop, but ordinarily much more may be made of it by feeding it to live stock and returning the manure to the land.

Barnyard Manure.

The latter method is the one followed in one of the Ohio station's experiments, which has been in progress for eighteen years, the manure being applied to corn in a three-year rotation of corn, wheat and clover. The outcome has been that

when 8 tons of manure has been taken directly from the stable to the field and spread on an acre of land in January, to be plowed under in preparing the land for corn the following April, it has increased the three crops — corn, wheat and clover — by a value equivalent to an average of $3.60 for each ton of manure. When 40 pounds of gypsum has been mixed with the ton of manure before spreading, the increase has been worth $3.76, after taking out the cost of the treatment. When kainit has been used instead of gypsum the net value of the increase has been $4.04; when raw phosphate rock has been used the net value has been $4.80; and when acid phosphate has been used the net value has been $5.40, the reinforcing materials being used at the rate of 40 pounds per ton of manure in every case, and the cost of treatment being deducted. Corn is valued in these estimates at 50 cents a bushel, wheat at $1 and hay at $10 a ton, no account being taken of stover or straw. By this treatment the yield of corn has been raised to an eighteen-year average of 66 bushels per acre, and that of wheat to 27 bushels.

Parallel with these tests, on another series of plots, manure has been used in the same quantity as weighed from the stall, but it has been allowed to lie in flat piles in the barnyard, after being weighed out in January and treated with the reinforcing materials, until the land was ready for the plow in April, when these lots were spread and plowed under. The outcome has been an average loss of 74 cents on each ton of the exposed manure as compared with that which went directly from the stable to the field.

The large effect of the phosphates used in the reinforcement of the manure has no doubt been due to the hunger of this soil for phosphorus and to the kind of crops grown. On a soil used for crops requiring potassium more urgently than phosphorus it is to be expected that kainit would produce a relatively larger effect.

In the Ohio station's tobacco-wheat-clover rotation, however, fresh manure reinforced with acid phosphate has produced increase to the net value of $7.45 per ton of manure, as against $6.63 for untreated manure, this larger value per ton being due to the high acre-value of tobacco as compared with the cereal

crops. In this experiment the kainit treatment has not been repeated.

These experiments have demonstrated the possibility of increasing the effectiveness of raw rock phosphate by incorporating it with manure, but even after this has been done the acid phosphate has usually been the more economical material to use. Where we have used acid phosphate and raw phosphate rock side by side, as direct applications to the land, the difference in outcome has more than covered the entire cost of the acid phosphate.

Fertilizing Truck Crops.

Thus far I have discussed the question of fertility maintenance from the standpoint of the farmer whose chief product is the cereal grains, and this farmer represents the average Ohio farmer. But even in Ohio there is a considerable and constantly increasing class of farmers whose chief interest is the production of the vegetables required by our rapidly growing cities, which already contain more than half the total population of the State, while in Massachusetts the production of the cereals sinks into insignificance when compared with that of vegetables and fruit.

It is true that the great farm product of Massachusetts is milk, no other single product equaling it in value, and the production of milk probably exhausts the phosphorus supply of the soil quite as rapidly as that of the cereal grains.

The Massachusetts dairyman is a large purchaser of oil meals and similar feeding stuffs, some of which, especially the wheat offals, carry a considerable percentage of phosphorus. It would require, however, a daily ration of 6 or 7 pounds of wheat bran or cottonseed meal to carry into a ton of manure as much phosphorus as has been added in 40 pounds of acid phosphate. Moreover, the manure used in these experiments has been produced by fattening cattle, fed a ration high in this element.

Phosphorus, however, is not the only important element in which the soil may be depleted through an uninformed system of agriculture. The Ohio Experiment Station has been conducting a series of experiments in the feeding of milch

cows under such conditions that the income and outgo of all the elements of the food is accounted for, the outcome of which indicates that under ordinary management a cow giving a larger flow of milk will lose calcium, the basic element of lime, more rapidly than she is able to absorb it from ordinary feeding stuffs. Calcium and phosphorus are closely associated in bone and in the phosphatic rocks which are employed in the manufacture of fertilizers, and this work in feeding, which is supported by our twenty-year experiments in the production of field crops, indicates that under dairy husbandry a soil may be depleted of its lime quite as rapidly and as completely as of its phosphorus.

Liming the Land.

In planning these field experiments no provision was made for the use of lime, but it very soon became apparent that this thin soil — which had been under cultivation for three-quarters of a century, the last third of the time under tenant husbandry — was very inhospitable to clover. The seed would be sown in March in the wheat, and at harvest there would be a complete stand of clover plants, but they were small and weak, and by the next season would have largely disappeared, their place being taken by sorrel.

In the spring of 1900 one-half the land was dressed with fresh burnt lime, used at the rate of a ton to the acre, the lime being spread across one end of all the plots, fertilized and unfertilized alike. This treatment was continued until each of the five tracts of land included in the experiment had had one application, after which ground raw limestone was substituted for the caustic lime and has been used since, using first 1 ton of the limestone dust per acre, but later increasing the dressing to 2 tons.

The outcome of this treatment has been an average increase in value of the crops of the rotation amounting to three times the cost of the liming. The statement has been made that corn does not need lime, but in this test the liming has produced an increase of 20 per cent in the corn yield on the unfertilized land and on that receiving acid phosphate only, and 9 to 15 per cent on that receiving a complete fertilizer or barn-

yard manure. Part of this increase is no doubt due to the secondary effect on corn of the largely increased clover crops, but a very considerable gain became manifest from the first application of the lime and before the clover had had opportunity to produce its effect. Moreover, the great corn lands are those well supplied with lime.

Oats has shown the least effect, varying from nothing on the land receiving a complete fertilizer, with nitrate of soda as the carrier of nitrogen, to 18 per cent on the unfertilized land.

Wheat has been increased by 8 to 10 per cent after the complete fertilizer and manure, and 27 per cent on the unfertilized land.

Clover has shown the greatest increase, the gain in yield of hay ranging from 27 per cent on the manured land to 44 per cent on the unfertilized land and that treated with acid phosphate. These figures do not tell the whole story respecting the clover crop, however, for a large proportion of the hay on the unlimed land has consisted of sorrel, plantain and other weeds.

Timothy, the fifth crop in the rotation, has shared in the general prosperity, giving a yield 12 to 25 per cent greater on the limed than on the unlimed land.

It seems probable that the relatively low effect of the liming on the oats crop is due to the management of the land. The lime is applied to the surface after plowing for corn, and harrowed in. The corn stubble is plowed under for oats, thus burying much of the lime below the reach of the oat roots. The oat stubble is plowed for wheat, bringing the lime to the surface again, where it is in the best situation to benefit the clover and timothy which are seeded on the wheat in the spring.

Lime performs a double function in the soil. In the first place, its two mineral constituents, calcium and magnesium, are included in the small list of those elements which are indispensable to the living organism. Every living cell, whether of plant or animal, contains these elements. For this purpose we would not need to use lime in any larger quantity than we use other fertilizing materials; in fact, our ordinary phosphates, which are combinations of phosphorus with calcium, would contain enough calcium, at least for most conditions.

But the function of lime which concerns us most is that of neutralizing the acids which appear in many soils that have been long under cultivation, and which render the soil inhospitable to clover.

An erroneous idea has sometimes been entertained respecting soil acidity. People talk of "souring" the land by turning under a green crop, but the acid developed by this treatment would be carbon dioxide, or carbonic acid, a gas any excess of which would very soon escape from the soil. The acid which causes the soil to redden blue litmus paper and causes clover to fail to grow is not an evanescent gas. The work of the micro-organisms which convert the organic matter of the soil humus into nitric acid would give a plausible explanation of soil acidity, for unless the nitric acid formed by these organisms is removed or neutralized it must eventually accumulate to such an extent as to become toxic to the organisms producing it. If there is an abundance of lime in the soil this acid will combine with the lime, forming nitrate of lime, a neutral salt.

Indirectly, therefore, lime increases and conserves the nitrogen supply by encouraging the growth of clover and other nitrogen-gathering crops, and by forwarding the processes by which the organic nitrogen of the soil is made available.

Returning to the fertilization of truck crops, while the same fundamental principles apply to all crops, yet it may sometimes be justifiable to neglect some of these principles. For example, a crop may have such a high acre-value, and land suited to its cultivation may be so limited, that as a business proposition it may be more profitable to purchase all the nitrogen required for its production than to attempt to secure the nitrogen through the growing of leguminous crops.

Take the onion, for example. A crop of 1,000 bushels would contain 100 pounds of nitrogen, and a crop of clover that would make $2\frac{1}{2}$ tons of hay would furnish this quantity of nitrogen in its tops, and half as much more in its stubble and roots; but there may be conditions under which the rental value of land that would produce such a yield of onions would be so high that it would be better business to buy the nitrogen outright than to hire the clover to steal it.

This point is forcibly illustrated in the culture of vegetables

under glass. Something may certainly be gained by rotating leguminous crops, but with land costing $2,000 an acre and upward, and crops worth as much or more than that amount annually, the growth of a crop merely as a nitrogen gatherer is not to be thought of.

The same general principles apply here, however, as to field culture, namely, that the soil supply of nitrogen, phosphorus, potassium and lime must be maintained, and that in proportion as we understand and apply the principles governing the economical maintenance of this supply, in that proportion will be our success in crop production.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 66.

January, 1917.

ADVERTISING AGRICULTURAL PRODUCTS.

HENRY KING HANNAH.

FROM THE SIXTY-FOURTH ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
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ADVERTISING AGRICULTURAL PRODUCTS.

HENRY KING HANNAH, NEW YORK CITY.

Somebody has reminded us that the first advertising of which we have any record occurred in the Garden of Eden, when the serpent held forth to Mother Eve about the great benefits to be derived from eating a certain fruit which grew there.

Thus when we come to talk about advertising farm products we can well claim that farm products were among the very first things to be advertised. Somebody has been unkind enough to suggest that if this is the first authentic piece of advertising, then the devil was the first advertising man, and that all the evils which came from this Eden episode can be laid at the door of the susceptibility of woman to the wiles of the advertising man.

But let me remind you that new theology has come to our rescue, and, in claiming that the fall was in reality a fall upward, provides for us advertising men a convenient way of escape. It says that to eat bread in the sweat of one's brow is the only dignified way to eat it. I rather think so myself.

But there is one question which can be introduced here, and one on which I want to venture an opinion. It is now somewhat the fashion for advertising men to argue that advertising lessens the amount of sweat which the consumer must exude in order to get the necessary money to pay for his living, and that advertising lowers the price of goods. The theory is that advertising creates demand and demand increases the output, making it possible for the manufacturer to reduce cost, and this he passes on to the consumer. If business was a philanthropy and the average business man a philanthropist this might happen, but, as a matter of fact, it does not happen. Now there are certain advantages which the purchaser of trade-marked goods does get. The quality of advertised goods

is generally high and uniform, but that the consumer pays less for them than for goods of equal quality which are not advertised is not true. A little investigation will easily show that advertised goods are the highest priced goods on the market, and if life is to be reduced to terms of mere dollars and cents, then it would have been better had the first advertisement never been written, and by it men forced to buy something they did not want, for in that case they could have lived more cheaply.

But all civilization has been enforcing on mankind something different and better than it already had, regardless of cost. Indeed, cost of any kind is the real stimulus to effort, and luxury is not measured by any material standard whatever. Somebody has said, "Give me the luxuries and I can dispense with the necessities of life," meaning, I take it, that as humanity progresses, what at one time seemed luxuries become necessities through the gradual cultivation of taste through the imagination. Civilization is but the story of how the race has gradually builded unto itself luxuries and made them necessities.

Now advertising increases the cost of living for the consumers because the very argument for advertising is that it has the power to create a monopoly. I am here to talk to you about the value of advertising farm products, and my whole argument will be based on the idea that advertising has the power to so gain and hold attention and move men in given directions that it takes away, if you will, their power of choice. In other words, it creates a monopoly; but if you give them the worth of their money, then it is justified.

Although myself an advertising agent, and making my living by attempts to create monopoly by advertising, I still watch with rather jealous eye the power of advertising over my own household. I suggested not long since to the general manager of my household the idea of buying cereals in bulk. She did so. Nothing was said beforehand to indicate the change to a more sensible, because more economical, régime, but with the first mouthful my youngest son began to look puzzled and then to dig for something that annoyed him. Soon others were doing the same thing. It seemed to me a

good deal of fuss to make about a little inoffensive hull, and I so expressed myself. I was the only one who did not find fault. In fact, I detected rather a good flavor to the cereal, but I swallowed all the hulls and we are back to advertised trademarked oatmeal.

I bought an automobile this spring. Being of more than average length, the particular machine appealed to me because it had plenty of room back of the stearing post for my legs. It had been painted not to the liking of the general public, and so the price was cut $200. It looked like a good car, and experience has proved that it is a good car. It suits me all right except in one particular, nobody knows about this particular kind of car. I start out riding with some friend and he begins by asking me, "What make of a car is this?" I reply, "This is a Snyder." "A Snyder? A new make?" "No, not a new make," and for fifteen or twenty minutes I am on the defensive. I am doing what a little advertising would have done. I have to justify myself in buying and driving a car that nobody ever heard of. There is one car which uses as a slogan, "Ask the man who owns one," but nobody has to do that with a car well advertised, and I think when I come to buy another car it will be one that others have heard about. Even if it costs me a couple of hundred dollars more, it will be worth the difference in peace of mind.

One more illustration. Some few years ago I bought an old house and built it over. Wanting to live in it, I put 80 per cent of the expenditure on the inside and 20 per cent on the outside. Since then there have been occasions when I should like to have rented this house furnished, but the real estate agents of my town tell me that it is difficult to get prospective renters to stop and go inside the house. They look at the outside and pass it by. The outside is the advertising side, and I neglected it to my own loss. My conclusion here is that we live in an age of advertising, and, while it adds to the cost of living, it is not something we can dispense with if we are to be at home with the age in which we are compelled to live.

Advertising is essentially a part of our business life — largely if you will — because it appeals to the imagination, and the want of imagination is what distinguishes a savage from

a civilized man. The more civilized a man is the more active his imagination, and the more his physical taste is dominated by that part of his mind called his imagination. The active man comes in here. I will bet a nice red apple that some advertising man invented that name "Sunkist," but the name "Skookum," like Topsy just growed. Now, you can argue to yourself all day that there was never an apple or an orange that ever grew that was not brought to proper maturity and color by the direct actions of the sun's rays, and you can argue the same way with the American people, but, after a year or two of advertising, the same public will say, "Yes, that's true. Please give me a dozen Sunkist oranges." The dealer will say, "Well, we haven't any Sunkist oranges to-day, but here are some just as good." "Well, why haven't you the kind I want?" (explanation and more argument) and the dealer says to himself later, "Well, I must have some of these oranges wrapped in Sunkist paper just to save me an argument." There may be — there undoubtedly are — other oranges just as good as Sunkist, but I tell you the man who eats an orange in the morning marked "Sunkist" eats it with his imagination alive, — with that poetic figure of Old Sol and the orange under the mistletoe, or the orange blossoms, — and the orange is sure to taste good.

I suppose the Maiden Blush Apple was named before the days of advertising men, but the man who so named it had the making of either a poet or an advertising man. Skookum apples may be very good, but the name is a hindrance rather than a help.

Now, I think New England has rather the advantage of any other section of the country in its power of appeal to the imagination. It starts with certain advantages, — with a reputation for honesty and fair dealing for one thing, which is important.

Then the natural beauty of New England is a tremendous asset, — its infinite variety and charm, the wilds of Maine, the mountains of Vermont and New Hampshire, the hills and valleys, orchards and farms of Massachusetts and Connecticut. You get the finest summer climate of any section of the United States, and you may expect many millions to come to New

England within the next twenty years, and these people just live to get back here.

Then consider how broadcast over the United States are the people who within a generation or two emigrated from New England. These all with one accord give attention when you talk about New England, for I take it that there are two sides to this advertising proposition about which we are thinking. Sometimes in the advertising business we dangle our bait over one fish in order to catch another. There are what we call the direct and the indirect results of advertising.

Much money is spent in advertising that never results in any direct increase of business. Of course, millions of dollars are wasted every year in advertising, but that is through stupidity. There never was any advertising properly done that did not accomplish results more or less beneficial, and, if you were to decide to advertise New England farm products, the first result would be to call the attention of the farmers of other sections to the fact that New England can raise farm products. A transformation has gone on in the farm situation in the great farming States of the west. Land has become so high in price that the small farmer can no longer afford to own it. He is selling out to the big farmer, who has the capital to farm on a big scale. Where can these men go? A few of them are going to Canada to settle in the wilds of the Northwest, some of them 500 miles from the nearest railroad. A few are coming back east as far as Pennsylvania and New York State, but more of them should come to New England. As a matter of fact, New England must bring them back, and if Massachusetts, for example, will back up the kind of work your State secretary is doing, it will fetch them back, and the abandoned farm will read like a fairy tale. You must have farmers to have a healthy community. It is quite fashionable to abuse Germany just now because of her so-called militarism. To say that the German people are nothing but an army in disguise is a great mistake. No nation of Europe, unless it be France, has been so careful to keep among her people that healthy balance between those who work at manufacturing and those who till the soil, and in no country in Europe has the farming industry been so adequately developed as in Germany.

You are all familiar with the history of agriculture, but one thing cannot be too often repeated with a warning, — the economic balance must be restored by bringing farmers to New England. I think the secretary of your State Board has said that Massachusetts alone sends out of the State every year $300,000,000 to pay for products which she could raise on her land that now lies fallow. No community can import its raw materials for manufacturing and then import the food of its workers and compete with other sections. The larger the quantity of raw manufacturing products it imports the greater the necessity for raising its own food. To do that you must have farmers. To get them, the easiest way is to advertise. Massachusetts could well afford to pay $100 for every new farming family moving within its borders, and yet I believe that with proper advertising they could be gotten here for about $25, and I would do it indirectly. I would do it by a campaign of advertising New England farm products.

The first requisite necessary to any successful advertising campaign is to have your product and have it in marketable condition. To get your product in marketable condition and in quantity to advertise it profitably, the individual farmer must associate himself with others, all of whom must submit their product to certain standardizing conditions. In some New England products this has already been done. I understand that the cranberry growers of Massachusetts have a selling organization, and I take it for granted that this means that the product submitted for sale is standardized and, in a way, guaranteed as to quality. I have been told that this selling organization has eliminated many evils of which complaint was made under the method of commission house sales, and that prices have been more uniform and generally better. Now the missing element in this cranberry situation is the element of advertising, for I take it for granted that inasmuch as the cranberry originated on Cape Cod the quality of fruit gathered there is better than that harvested anywhere else. Cape Cod cranberry growers tell me this is so, and I believe them. Now, if I were the manager of this association of cranberry growers I would move heaven and earth to get an appropriation of money for the purpose of showing people that cranberry sauce

tastes about as good at other times as on Thanksgiving Day, and fits roast chicken about as well as roast turkey; and, what is equally important, no turkey or chicken ever came to the table quite so content as when it knew that the sauce was made from berries grown on Cape Cod. A Vermont or Rhode Island turkey always requires a Massachusetts cranberry, as a matter of course, but all others should be given the same pleasure. I would not advertise, expecting by such advertising to increase the product and lower the price, but rather to increase the price or, at least, to maintain the price year after year at a level yielding a fair profit.

Speaking of Cape Cod leads me to call your attention to the strawberry industry. From what I see growing down there, and the quality and size of the fruit, I would not be surprised if Cape Cod could be made the home of small fruits, and a demand created in this whole eastern country for Cape Cod strawberries, blackberries and raspberries. These growers are likewise organized for selling purposes, and the next step ought to be some advertising, pretty well organized too, and quite loyal to the rules of their organization.

Now, while I believe advertising would be a good thing for the cranberry or strawberry growers of Cape Cod, I would not relish the job of trying to extract from them the money it would require to do it. Farmers are pretty "set" in their ways, and the profits of farming do not look large enough for them to see much of it go for co-operative efforts along lines that do not yield pretty easily seen returns.

Some years ago, — not so many, — through the efforts of a young lawyer in a certain Kentucky town, the growers of Burley tobacco organized an association, and by means of it forced the tobacco trust to pay better prices for tobacco. I think the returns for one year, at least, were something over a million dollars better than the year before. The young lawyer charged the association $10,000 for his year's work. These days a man who could increase the selling price of a firm's product $1,000,000 a year for that salary would be classed as a Simon-pure philanthropist, but not so with those Kentucky farmers. To them this young lawyer's salary looked too big and they fired him. He probably shortened his life several years just getting them organized.

Not to name all the things that could be exploited to the advantage of New England, — there are Maine potatoes. Advertising could place them in a better position than they occupy to-day. I am told that there is something in the soil and the climate of New England that makes it the best apple section of the United States. A couple of years ago I had sent me a box of apples. I kept this box in my office in New York, and when I had a caller who looked like an apple eater I would take off the paper from one and hand it to him. After looking at the color and size, and sampling it, he would probably say, "Well, those people out in Oregon certainly know how to grow apples, and they are getting a better flavor all the time. What part of Oregon did this apple come from?" I would then spring my little joke by showing him the end of the box, or the paper wrapping, marked Fitchburg, Massachusetts. He then might say, "Why, I thought they only raised cooking apples up in New England, called Baldwins."

Now, that man in Fitchburg knows how to raise apples. If there were 500 such men in Massachusetts and each of them raised 2,000 boxes — 1,000,000 in all — they ought to bring about $2 a box wholesale, or $3 to the consumer, that is, by the proper amount of advertising.

Somebody might say, "Why, I can buy nice apples for $2.50 a box." True enough, but those are Oregon apples. These are New England apples. "Grown in New England" on a box, bag or package would stop all argument.

If you would like something tangible to think about and discuss, here is my proposition: give me $100,000 a year for five years, and be ready to supply the products in marketable condition, and I will increase the income for New England farm products in those five years at least $20,000,000, and, as a by-product, I will bring into New England in that time 10,000 families who will devote themselves to farming. If each of these families creates $1,000 a year profit, their wealth-creating capacity will be at least $10,000,000 and this will continue for many years beyond the five-year period, and so will the outside demand for New England products continue long after the advertising has stopped.

Another important thing such a campaign of advertising

would do would be to create a new spirit among those who are now New England farmers. Very often one of the first appreciable effects of advertising is its influence on the officers and employees of the company doing the advertising, in changing their attitude toward their business and toward the public. They see their own business in a new light; they take on new ambition to push it to new achievements.

Advertising would give new dignity and importance to agriculture in New England in the eyes of those who now practice it. The rank and file of farmers would push in to join your association and get into the tide of improvement. It would appeal to the farmer's imagination and make him feel that he was an important member of a great forward movement. It would increase his efficiency and his output. Does this sound like a fairy story? Has another serpent gotten into Eden? I am speaking words of truth and soberness, really underestimating the results than otherwise.

Do I ask you to look upon me as a miracle worker? Am I a modern Joshua commanding the sun to stand still? Well, something like that. I do confess to believing that for the right man doing certain things in a certain way the sun does stand still. I saw the sun stand still once myself. Some years ago I was on my way from Boston to Newport. About 6 o'clock in the afternoon the train came out on a stretch of track running for some miles along the shore of Narragansett Bay. The setting sun stood a round red disk on the brow of the hill over toward the west. Glancing up a few minutes later from a book I was reading, and expecting to find the sun half hidden behind the hill, I saw it poised in full view. When I looked the third time out of the window and saw the sun in the same place I began to realize that I was seeing something quite unusual, and for a full half hour the sun stood still with its lower rim resting just on the brow of the hill across the bay. I crossed the car to see if I could find an explanation of this extraordinary phenomenon. Once seated where the car window did not frame for me a small section of the view, and where the whole stretch of country could be seen, the explanation was clear. A long hill skirted the water for miles, with its highest point back at the head of the bay where I first saw the sun,

and tapering to a point some miles ahead. My train was traveling about 30 miles an hour, so that the setting, the declivity of the hill, and the speed of the train all combined to make the sun to all appearances literally stand still.

I thought of Joshua, and when I got the chance to read the story I saw that something of the same thing must have happened. Joshua, so the story says, was pursuing his enemies down the valley of Bethhoron. It was probably in the evening. He must have seen the sun across the valley just over some tapering hill, somewhat as I saw it. He was going so fast and the lay of the land was such that the sun seemed to stand still, and, being a man of imagination and needing more time to accomplish his job, he commanded the sun to continue doing what it seemed already willing to do. The busy, resourceful man always makes the sun stand still; always lengthens every day by putting more into it.

Now, I think this a fair picture of what happens to some business men. To most men in business — even the business of farming — the land always lies just so; the sun sets on a certain day at a certain time; in other words, economic or business conditions always seem fixed and unalterable. Such and such things have always been done just such and such ways, but now and then along comes some Joshua whose rate of progress down the valley of business never allows the hill of tradition or prejudice or fixed condition to get between him and the daylight. The consuming public is shifting its position every minute, and this man, by keeping alert and moving, keeps himself from eclipse, and very often this modern Joshua is a man who has come to see the value of advertising.

There are yet some kinds of business, like farming dead to the value of this miracle-working power in modern business. Progressive in methods of agricultural procedure, the business side of your life has been anchored to one spot for years, while over to the west is the red landmark sometimes known as the commission merchant, the jobber or the retailer, who owns the trade. Up to a certain point you prosper; you are warmed and fed by the sun of public favor; but ever, at a certain point, this sun gets behind these trade obstacles and you are kept humble and subservient. However, now and then some one individual

or association more enterprising, more alive, active and pushing than the rest, bids farewell to the red way, gets aboard the train of consumer advertising and starts down the valley of progress. A miracle happens. The sun of public favor — the interest of the buying public — which used to set at 5 o'clock keeps blazing away until 6, because, between the progressive business farmer and his buying public, the red hill of fixed trade conditions suffers so sharp a decline that long before sunset it has tapered to a point and vanished away.

It is that kind of a miracle that I believe advertising would work for you New England farmers. Why do you not try it?

The Commonwealth of Massachusetts.

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MARKET GARDENING.

R. H. GARRAHAN.

FROM THE SIXTY-FOURTH ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
32 DERNE STREET.
1918.

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MARKET GARDENING.

R. H. GARRAHAN, KINGSTON, PENNSYLVANIA.

Market gardening is the great American lottery. It is often a case of "heads, you win; tails, I lose."

To be successful in this business one should be a good loser — he should be an optimist. A pessimist asks, "Is there any milk in the pitcher?" while an optimist says, "Please pass the cream." He is looking for the cream, and he usually gets it. We have our troubles, to be sure; every one has; the manufacturer has his labor troubles, and the laborer has troubles of his own. Conditions are such that we will be compelled to make our operations more efficient. We must use labor-saving tools wherever possible, and eliminate a lot of the unnecessary risks that we are taking every year.

Farming is not an exact science, and in the growing and selling of perishable produce we must take a lot of chances. We must take our own chance with the weather, with the seed we use, and a long chance on the price we get for our produce. But do we not often take a lot of unnecessary risks? We may be preparing a piece of ground for a certain crop, and a few hours' more work would put it in ideal condition, but we are in a hurry and — well, that is good enough, let it go at that. We know that Bordeaux mixture is a fairly good preventive of certain plant diseases, but — it looks like rain, and if we put it on it might wash off, or we have something else to do, and we put it off for a more convenient season; as a result, that celery develops a fine case of blight.

On a great many market gardens there are opportunities for irrigation which are neglected, — either a creek, pond or underground water. Sometimes one good wetting at the right time makes the difference between profit and loss. Then, again, we are not always as particular as we might be regarding the source of our seed supply. I have known gardeners to send a list of their seed requirements to different seedsmen asking for their lowest bid. They were looking for something cheap, and, as a rule, they got what they were looking for.

We have been led to believe that there is something very mysterious about seed production, — that vegetable seeds could be produced only in certain favored locations. That may be true of some varieties, but I do know that you can raise, right here in Massachusetts, as good seed of cabbage, tomato, onion, beets or celery as can be raised in any other part of the world. We have been raising — for a number of years — our own cabbage, tomato, sweet corn and celery seed. This year I raised 20 pounds of celery seed on less than one-thirtieth of an acre.

I thought it might be better to tell you something of our crops, and methods of growing them, rather than theorize about the business. I am not very long on the theory, anyway. I have been working in vegetables all my life. As a kid I crawled for miles and miles and miles, on my hands and knees, weeding onions, with the summer sunshine playing tattoo along my back. I know what it is to cut cabbage all day in the rain, or to pull sweet corn with the thermometer at 110° and no air stirring. And I know what it is to get up in the wee small hours of the morning, and take the produce to market and sometimes sell it for less than it cost to grow. And yet, after all, there is something mighty fascinating about the business. I would not trade jobs with the fellow in the bank who is locked up in a cage and put under bonds.

We are situated in the northeastern part of Pennsylvania, in the historic Wyoming valley. The soil consists of river bottom, and varies from a light sandy soil to a heavy clay. We raised this year more than a million early vegetable plants, mostly cabbage, tomato and celery. We had 14 acres in asparagus, 27 acres in celery, 20 acres in tomatoes, 15 acres in early cabbage, 15 acres in onions, 6 acres in sweet corn, 8 acres in beets, 6 acres in spinach, 2 acres in carrots.

Every market gardener should have, at least, a small greenhouse and enough sash and cold frames to raise all the plants needed for his own use. The soil used for plant raising should be of a loose, porous nature, to allow perfect drainage. Leaf mold is nature's seed bed, and probably the best substitute is made by using sods and well-rotted manure. We usually put down about a foot of sods, then add one-half foot of manure,

and so on until we have sufficient for our own needs. In about a year's time the sods will be thoroughly rotted. The pile is then turned, and, after the addition of lime, is ready for use.

All our early plants are raised in flats, as we can produce better plants by use of flats than by putting them in beds. We prefer to transplant the seedlings before the rough leaf appears. It has been my experience that we get a more uniform stand of plants by using them when quite young. A little practical experience is necessary in order to grow good plants. It is hard to say, without being on the job, just when to ventilate or how much water to apply, and watering and ventilating are the important points in plant raising. As a rule, the beginner is liable to coddle his plants too much; as a result he will have a lot of weak, poorly rooted plants. One should avoid extremes of heat or cold while the plants are young, aiming to develop a slow, steady growth. The greatest loss in plant raising is caused by the damping-off fungus. This disease usually attacks the seedlings, causing the stems to turn black and rot off. Since using sterilized soil we have had little trouble with this disease. The plants are left in the greenhouse until they have struck root; they are then shifted to cold frames. Most of our frames are steam heated, which has proved perfectly satisfactory, and is much cheaper than protection by straw mats.

There is no better test of one's ability as a market gardener than the quality of the plants he raises. If he is painstaking enough to grow a supply of strong, healthy plants, it is a safe bet that his field operations will be equally successful.

The asparagus we grow is the Palmetto variety. It is planted 2 by 4 feet and 5 or 6 inches deep. Success, to my mind, depends upon the selection of a well-drained soil supplied with abundant plant food, and the use of well-grown plants from high-grade seed. It is a mistake to start an asparagus bed on poor ground. The future of the bed will depend a great deal upon the condition of the soil when the field is set. If possible, choose a field where onions, or a similar crop, has been raised for a few years previous. Asparagus is a crop that requires heavy feeding. Before the war we applied a ton of 6–8–10 fertilizer per acre, part of the nitrogen in the form of nitrate of soda, the balance in tankage. The fertilizer is applied early in

the spring, just before the first shoots appear. About every third year we apply a heavy coating of manure, after the cutting season. When asparagus becomes weedy — during the cutting season — we ridge it up on a Saturday with an old-fashioned moker. This smothers out all the weeds and saves the expense of hand-pulling. After the cutting season the field is thoroughly disk-harrowed; and at the last cultivation, when the asparagus is laid by, it is again ridged up. In the spring these ridges are cut down by the use of a ridging cultivator. For this purpose the disks are put close together on the cultivator and arranged so as to throw the dirt between the rows; the small plows are fastened behind the disks. This arrangement levels the ridge and leaves the surface over the row free from weeds and stubble.

Onions.

Both the early and late onions have proved profitable with us. There is no crop that responds more readily to decent treatment. It pays to put the ground in good shape for all crops, but with onions it does not pay to plant them unless the land is first put in the best of shape. Under most conditions I think it would be preferable to manure the ground in the fall, and plow just before the ground freezes; then in the spring prepare the ground with cutaway, acme and meeker harrows. As our land is liable to overflow from the river, we prefer to plow in the spring.

Before plowing, the ground is gone over two or three times with a four-horse cutaway. We are able to stir up the soil with the cutaway when it would be entirely too wet to plow. The action of the cutaway loosens the surface of the soil and allows the air and sun to penetrate, thus permitting us to plow a week or ten days earlier than we otherwise could. A few days after cutawaying, depending upon the condition of the soil, the field is worked over with an acme harrow to break up any lumps that may have formed. After plowing, 30 or 40 tons of well-rotted manure is applied per acre, and worked in with the cutaway harrow. The ground is then harrowed over with the acme and plank-drag until it is in the best condition. The finishing touches are then put on with the roller and meeker smoothing harrow. Time spent in preparing land for onions,

or any other crop, is not wasted. Some people have an idea that if land is plowed and harrowed over it is fit to plant.

If the ground is very dry at the time of sowing we roll down the rows after seeding with a heavy 4-inch iron wheel, rigged up something like a wheelbarrow, in order to firm the soil over the seed. This takes the place of "the use of the feet in sowing," as advocated by Peter Henderson a generation ago. About 5 pounds of seed is sown per acre, depending upon the percentage of germination. We have been raising the Southport Yellow Globe and the Ohio Yellow Globe. They are both good varieties. We have tried two makes of weeders, — the Brunner we sent back over the Border; the Golden we still have. But as long as we can get Polish women at $1.25 and children at 60 cents per day, I believe we will stick to the hand work.

For early onions we use sets, the so-called "new method," which consists of using plants started in a hotbed, having proved unsatisfactory. We find it important to grow our own sets, as the commercial ones are very often raised from inferior seed. Yellow Strasburg, a small flat onion, is generally used by the growers in production of sets, as a flat onion always makes a better shaped set, whereas the globe-shaped onion will produce one that is bottle shaped. As appearance is not what we are after we use the same variety and the same grade of seed as in the production of large onions.

We also grow considerable Prizetaker sets. This variety matures about two weeks later than the Southport Yellow Globe, but will yield a much larger crop. We have found the Prizetaker sets just as easy to grow and as good a keeper as the ordinary variety of onions. About 50 pounds of seed per acre is used. This is sown as early in the spring as possible, on well-enriched, sandy soil. When the onions begin to mature they are pulled and laid on the ground for a few days to dry. They are afterward picked up, part of the top twisted off, and stored in shallow, slat-bottomed crates. In planting the sets we often skip every third row. These skipped rows are afterwards planted with celery. The yield per acre is usually less than from seed, but the price is often higher, and the onions are out of the way for a later crop.

Cabbage.

Early cabbage has always been one of our standbys. It is a comparatively cheap crop to grow. Some years we have to sell it at rather a low figure, but, one year with another, it is a money maker.

We have settled on three varieties, — the Wakefield, either Early Jersey or Charleston, Copenhagen Market and Glory of Einkhausen. They make a combination that is hard to beat. We make the first sowing of cabbage seed about the middle of January. The early varieties are transplanted in flats, 2 inches apart. The later varieties we set $1\frac{1}{2}$ inches apart. Cabbage is a rank feeder and requires well-prepared soil and heavy fertilization. To my mind, there is no room in a cabbage patch for lettuce or radishes, or any other intercrop. If possible, we prefer to have the ground intended for cabbage sowed to rye the fall previous. Before sowing the rye we apply about $1\frac{1}{2}$ tons hydrated lime per acre. We have had less trouble with wireworms where we have plowed under a heavy growth of rye. The cabbage plants are set in rows $2\frac{1}{2}$ feet apart. The Wakefield varieties are set 15 inches apart, and the Copenhagen and Einkhausen 18 inches apart, in the row. Early cabbage should not be set deep; keep the roots near the surface where the ground is warm. The early varieties, which are grown 2 inches apart in the flats, are cut out with a knife in order to retain all the soil possible, and are planted by hand. We never use a dibber in setting cabbage plants. A few days after planting we apply a small amount of nitrate of soda around each plant, say from 100 to 200 pounds per acre. The after-treatment consists in keeping the field well cultivated, and hoed often enough to keep the soil loose around the plants.

When the cabbage is ready to cut, a row of barrels is placed through the field every twelve rows. Two men cut the heads, each man cutting six rows. As the cabbage is cut they toss the heads to another man or boy, who places them in the barrels. The filled barrels are hauled out with wagons. Some heads are destroyed, especially when turning the ends, but the loss is nothing in comparison to the expense of carrying the cabbage out by hand.

Tomatoes.

Tomatoes are an important crop with the market gardener. As the early tomato produces greater returns per acre, it is the one that receives more attention from the grower. The condition of the plants at the time of setting has a great deal to do with the profitableness of the crop. The plants should be about ten weeks old when set in the field. I would rather have a plant that is showing bud nicely than one that is in bloom. Tomatoes should be transplanted at least twice before they are ready for the field, the idea being to develop a stocky plant. This can be accomplished better by withholding water than by exposure to low temperature. A stunted tomato plant is worthless. An oversupply of nitrogenous fertilizers will prove detrimental; it will force top growth at the expense of the fruit. On many market gardens, where the area is limited and the soil has been receiving heavy applications of manure and fertilizers, it becomes necessary to stake and prune the vines. Staked tomatoes produce the bulk of the crop earlier and the fruit is smoother and less liable to crack, but they are more likely to suffer from drought. Where one is making a specialty of staked tomatoes, it is important to have facilities for irrigation at the critical time. All the large growers that I know of have developed a strain of tomatoes that they consider the best in the world. I believe they are right. After a few years of careful selection one has a type that is peculiarly adapted to his local environments. We use Earliana and Chalk's Jewel. Earliana has proved the money maker with us. Chalk's Jewel is used for later crop.

Celery.

Celery is another of our hobbies. For early celery we use White Plume. The quality is poor, but consumers down our way are willing to pay good money for it early in the summer. It is a rapid grower, and is not nearly so liable to heart rot as most other varieties.

There is a variety that has been on the market for several years that, as it becomes better known, will take the place of White Plume and Golden Self Blanching. This variety originated with a Mr. Meish of New Jersey, and was first sold by

Berlieu, the French seedsman of Woodhaven, New York, as "Meish's Green." Later it was offered by Francis Brill as "Sanford." Then Henderson took it up and offered it under the name of "Easy Blanching." Most seedsmen have it listed now, each one calling it by a different name.

This is a remarkable celery in many respects, — a strong, vigorous grower, with a compact heart; it will bleach as quickly as White Plume or Golden Self Blanching, is almost blight proof, and the quality is superior to any other early variety. Another desirable feature is the fact that it is a fairly good winter variety, and if put away green will keep until spring; in fact, one of our Philadelphia seedsmen offered it this year as a new late keeping variety. There have always been two types among this celery, at least ever since I have known it. The one type has long stems and bleaches up white; the other type has shorter stems and bleaches up with a yellow heart. Last spring we received some seed from Farrel Brothers, Philadelphia market gardeners, who have been saving their own seed of this variety for a number of years, and have been selecting for seed purposes only those specimens which show a yellow heart. As a result, they have to-day the best strain of this variety in the market. There is one undesirable feature about this celery, — it, will very often get pithy when stored for winter, especially if the weather is warm after trenching. We have found that if trenched as late as possible in the fall it will seldom turn pithy.

We have tried, at one time or another, practically all the different varieties of celery that have been offered. Golden Self Blanching is not adapted to our conditions; it will heart rot in hot weather and get pithy when trenched. Columbia is a celery of superior quality, but a poor keeper, and more liable to rust than any variety I know of. Winter Queen is a good reliable celery, one of the best known late keeping varieties. The only objection I have to it is that it does not have a full heart; quality is fairly good. Winter King is probably a selection from the Winter Queen. It bleaches out with a yellow heart, and is very popular among the Philadelphia growers. The Giant Pascal probably heads the list in regard to quality, but with us is a poor keeper, and on account of extreme brittleness is more expensive to handle.

French's Success, introduced a few years ago by the Joseph Harris Seed Company, is one of the most uniform varieties of celery we have ever handled. It is a slow-growing, compact variety, and should be planted earlier than some of the taller growing kinds. It is the best keeping variety we have ever tried, and is very full hearted. I have counted as high as fourteen shoots starting in the heart, while in the Giant Pascal only two or three would be visible. The quality is good, but not equal to Giant Pascal. We have found this variety best adapted to our conditions.

The seed for the early crop is sown about March 1. I prefer to sow celery seed in solid beds rather than in flats. The soil is sterilized by saturating it with a solution of formaldehyde, 2 quarts to 50 gallons of water. And on the principle of "making assurance doubly sure," we sterilize the seed by washing it in a solution of 2 ounces copper sulphate to one-half gallon of water. When the rough leaf appears the seedlings are transplanted $1\frac{1}{2}$ inches apart in flats, and are kept in the greenhouse until they begin to grow nicely. Before shifting to the cold frames they are given a thorough spraying with Bordeaux mixture, and are also sprayed two or three times while in the frames. Celery plants should be kept growing nicely, without a check; ventilate freely and avoid too much water. Do not attempt to harden them as you would cabbage plants, but treat them more as you would tomato plants. They are not set in the field until the latter part of May or the first of June.

When the celery is large enough to bleach, the boards are hauled in the field, two adjacent rows are put up, then we skip four or six rows, put up two more, and so proceed. When the celery is bleached the boards are taken down and put up to the adjacent rows. Before the war we used the following fertilizer per acre: 400 pounds soda, 600 tankage, 600 acid phosphate, and 400 potash.

It is customary to plant late celery after some early crop, as beets, cabbage, or spinach. But where land is available, or where irrigation has not been installed, it is a good plan to plow the land intended for late celery as early as possible, and harrow it over occasionally in order to kill the weeds and conserve soil moisture, similar to the dry farming of the west. With this method we lose the use of the land early in the

season, but are almost sure of a good crop of late celery. And one good crop sometimes pays better than two poor ones.

The plants are set 6 inches apart, and rows 3 feet apart. Celery should be cultivated almost constantly, and the cultivator run quite deep, early in the season, while the plants are small.

Along in the latter part of September we begin to bank or hill up the celery. If the celery is small it is first necessary to handle it, but if it is a foot high all that is necessary is to loosen the soil between the rows with a cultivator, and follow up with the celery hiller. We commence trenching the latter part of October, or first of November, depending upon the weather. Trenches are dug about a foot wide and deep enough so that when the plants are placed in the trench the tops will stick out about 2 inches. The celery is dug up by an attachment similar to an onion set harvester, which is fastened to a two-horse cultivator. The celery is then pulled out, all the dirt possible is shaken from the roots, and a few of the outside leaves pulled off. It is then carried to the trench where it is packed in firmly in an upright position. The boards used in blanching the early crop are nailed together "V" shaped, and placed over the trench to keep out the rain and prevent the celery from drying out too much. After severe cold weather sets in manure is spread over the boards to keep the celery from freezing.

A great many growers make the mistake of trying to raise everything in the catalogue. We have found it a better plan to raise a few different kinds, and hit them hard. Find out what crops are adapted to your particular soil, and then go to it. Try and arrange your crops so they do not interfere with one another, either in the growing or selling.

The reason many growers fail to get a decent price for their produce is the fact that they do not ask enough. If you once get the reputation of being cheap, it is a hard matter to ever get a good price.

I am reminded of an old fellow who once worked for us. In order to eke out an existence on the meager wage he received he took in a boarder. He told me one day that he thought things would go better now as they got $10 a month from the boarder. "Huey," I said, "there is not much profit in boarding a man at $10." "Well," he said, "I reckon the board ain't worth much more."

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PASTEURIZATION OF MARKET MILK.

O. F. HUNZIKER.

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PASTEURIZATION OF MARKET MILK.

O. F. HUNZIKER, LAFAYETTE, INDIANA.

In order to convey to you the full significance of pasteurization of milk, I desire to call your attention for a brief moment to the importance and usefulness and greatness of the product which this pasteurization is all about. I mean milk.

You have heard the great virtues of sour, or fermented, milk discussed. Possibly you have read such books as "The Prolongation of Life," by the late Dr. Metchnikoff of Paris, or the book entitled "Old Age Deferred," by Dr. Lorand of Vienna. These eminent scientists suggest the possibility that the liberal consumption of sour milk stimulates and prolongs the activity of the thyroid gland and of other ductless glands and organs, thus keeping the body from showing signs of age, keeping it physically young, and possibly prolonging the cycle of life. To substantiate their statements these savants cite individuals of countries where sour milk forms the basic part of the daily ration, and who have lived to a very ripe old age, in some instances one hundred and fifty years old and over.

I am not questioning, nor am I trying to belittle, the beneficial influence on the physiological functions of the body, of the lactic acid and of the lactic acid bacteria which are present in this sour milk; but I am equally convinced that the fundamental virtue of that sour milk does not altogether lie in the fact that it is sour, but rather in the fact that it is milk, with all its inherent life and growth-giving properties, — milk which is the foundation, the God-given product. While the acid, in a similar manner as pasteurization, is a secondary attribute only, it is the decoration rather than the product which it decorates, — it is man-made, incidental. If we have a full understanding of the true importance and value of this foundation product, milk, then we are in a position to readily understand the great value and indispensable need of pasteurization.

Milk has no equal as a food for man, and its equivalent cannot be purchased at as low a price in the form of any other animal food, nor can its combined beneficial properties be found in any food which mother earth offers to man.

Milk is a complete food for the sustenance and for the growth of the human body. It contains all the necessary food elements, and nature has placed them there in the proper proportion for young and old. The food elements in milk are present in such form that they are more digestible and more easily assimilated than the same food elements in other forms of food products.

The fat of milk, which is largely found in the cream, is the most digestible fat nature provides. It not only produces heat and energy as do other fats, but it is capable of yielding vital properties which build up the nervous system, and of aiding in the ready digestion and assimilation of other foods.

The protein of milk contains the elements that produce blood and furnish the necessary material for the upbuilding of the muscular tissues of the body. It is the most digestible form of protein found in any food. It is not only easily digested and assimilated, but it contains physiological and vital properties which make for larger growth of muscle and bone than do proteids from other sources.

The sugar of milk furnishes the necessary heat that keeps the body warm and the energy that is needed to perform the cycle of the vital fluids, — to pump the blood from and to the heart, to expand and contract the lungs so they may purify the blood and circulate it throughout the body, stimulating the vital organs to maximum activity and nourishing and building up the tissues. The sugar of milk is the most digestible energy producer available; it is found nowhere else in nature except in milk.

The mineral matter, or ash of milk, furnishes the material that builds up the bony structure of the human body. It represents a most complete combination of minerals, salts and acids. It is present in the form most easily digested and assimilated by the organs of the body.

But the great value of milk as a food is by no means confined to the actual food nutrients which it contains, and to their

high degree of digestibility. Milk is more than a mere food of high nutritive value; it has properties of physiological and biological value which are not found in many other food nutrients, and which give it the precedent over all human food. Milk has vital substances which mean more to the living and growing body than mere food nutrients. The presence of these vital properties has been demonstrated in feeding experiments conducted with various classes of animals in experiment stations in this country and in Europe.

The addition of milk to the feed rations of pigs and hogs produces larger hogs, a larger bony structure and a heavier carcass than when these same food elements are secured from other sources.

Calves do better, develop faster and grow larger and heavier on milk as a part of their food ration than on a ration without milk.

Beef animals excel in quality of beef and show-ring performance when milk forms a part of their ration.

Chicken feeders are unanimous in their claim that milk, skim milk or buttermilk increases weight and produces a grade of meat that is unequaled by any other feed.

Experiments with laying hens have demonstrated that the feeding of milk, buttermilk and skim milk may increase egg production from an average of 40 eggs per hen per year to an average of 140 eggs per hen per year.

Many additional similar instances could be cited if time permitted, but these facts should suffice to unmistakably show the life-sustaining and growth-producing properties of milk. They furnish ample proof that milk is an indispensable food for the welfare, health and preservation of the human family. The infant cannot exist without it; the growing child needs it for its best and greatest development; the adult requires it for the proper maintenance of the body and for the maximum performance of mental and physical work; it is essential in the diet of the nursing mother in order to satisfy the baby at her breast; the invalid and the convalescent need it to regain their strength; it invigorates the aged and prolongs the cycle of life.

Business men, and men whose nervous system and mental force are taxed by the daily strain of mental work and worry,

are learning more and more to appreciate the advantage of milk in their daily diet. Clearness of thought and activity of mind are jeopardized by heavy food and overeating. Too much of their energy is consumed in the digestion of a heavy meal. The blood that should nourish the brain is monopolized by the stomach. The adoption of milk and bread as the mid-day meal largely removes this handicap. Such a diet is economical, simple, easy to digest; it does not rob man of the energy which he needs for work, it does not produce a sluggish mind, it is nourishing and refreshing and stimulates mental activity.

We would all be better off physically, and could have more available net energy for the performance of our work, if we consumed more milk and less of the other, often less suitable and usually more expensive, foods. There would be less indigestion, more real nourishment and a smaller monthly board bill for the human family.

In consideration of the indispensableness of milk for babies and children, and its beneficial effect on people of all ages, in view of the fact that liberal and increased consumption of milk is urged by all persons honestly interested in the raising of a healthy race of stalwart men of large stature and healthy women and useful citizens, and because the consumption of milk by the public actually is rapidly increasing, it is of the greatest importance that this milk which forms so basic a part of the diet of the human family, and especially of our babies and growing children, be free from agencies of disease.

The experience of those who have given the best part of their lives to the effort of eliminating the contamination of milk with germs of milk-borne diseases are unanimous in their admission that our best known and most up-to-date methods of production and handling of milk, and our most efficient systems of inspection, are inadequate and fail to furnish the public with a reliable guarantee for the safety of its milk supply from the health point of view. The government, State and municipal laws and ordinances concerning the production of sanitary milk, the testing of our dairy herds for tuberculosis, the inspection of dairies, the examination of milk in the city laboratories, — all these activities are helping to reduce the danger of infected

milk and to minimize the occurrence of epidemics of milk-borne diseases. But their service, after all, is not general, it is limited; the task is too immense, the expense involved too great, and the results too uncertain for the adequate protection of the public. The milk furnished to any one of our larger cities comes from thousands of farms; it is produced by tens of thousands of cows and handled by tens of thousands of persons.

The difficulty of complete supervision and protection is further augmented by the frequent change of cows and personnel on the farms. New cows enter the herds, new employees take the place of old ones, all of which may happen between periods of inspection. The virulence of some of the disease germs is such that infection occurring to-day may spread disease to-morrow. Perfectly healthy employees may serve as carriers of the germs of disease, so that protection is beyond the power of the inspector.

The hope that certified milk, which is milk produced under the supervision of a medical commission, and which, from the sanitary standpoint, is regarded as the most ideal milk, may ultimately solve the problem of a sanitary milk supply is no longer cherished. Even certified milk is not an absolute safeguard against infected milk. But assuming that it were, its high cost of production limits its output, and its high price to the consumer confines its availability to the wealthy classes only. The great army of milk consumers, therefore, must look elsewhere for a safe milk supply, and right here is where pasteurization comes to the rescue.

By pasteurization of milk is now understood the exposure of milk to temperatures high enough and for a sufficient length of time to destroy the great majority of the living germs it may contain without impairing its digestibility and marketable properties. Bacteriological analysis of milk and cream show conclusively that pasteurization, properly executed, is very efficient; it is capable of destroying on an average 99.9 per cent of the bacteria present, and it eliminates from the milk entirely the germs of such milk-borne diseases as tuberculosis, typhoid fever and diphtheria, etc.

The Lederle Laboratory of New York City, under the direction of Dr. H. D. Pease, tested out the pasteurizing efficiency

by inoculating milk before pasteurization with large numbers of virulent germs of tuberculosis, typhoid and diphtheria. The experiment was conducted in a commercial milk plant, under good average conditions in such plants. Their results, which were conclusive and unmistakable, show that pasteurization of milk under commercial conditions, using temperatures ranging from 142° F. to 147° F. for a fraction of a minute, and by additional holding of the pasteurized milk for thirty minutes to temperatures ranging from 143° F. to 145° F., is sufficient to insure total destruction of large numbers of pathogenic bacteria such as tubercle bacilli, typhoid bacilli and diphtheria bacilli, which through contamination, might be present in raw milk. This, then, means that pasteurization at 145° F., and holding for thirty minutes, destroys all the germs of the most common milk-borne diseases. Similar results with the same species of bacteria, as well as with other organisms of milk-borne diseases, have been obtained and reported by other investigators who rank high in the world of science, such as Russel and Hastings of Wisconsin, Theobald Smith and Rosenau of Harvard University, Marshall of Michigan, Burri of Switzerland and others. These important facts leave not a shadow of doubt that pasteurization, when properly executed, is a reliable and effective means to free the milk from germs of disease, and to supply the consuming public with a safe milk.

From the time of its inception pasteurization has had its enemies as well as its friends. Like other innovations of similar nature, pasteurization has run the gauntlet of public and professional opinion. In its early days and in its cruder form its advocates were few, and its progress was impeded by distrust of the conservative, quarrels of the faddist and abuse by the pessimist. As the process attained greater perfection, and its principles and good results became better known, the process gained in favor, its merits and usefulness could no longer be denied by men of intelligence and progressive mind, suspicion changed into appreciation and abuse into eulogy. To-day, while there still exists some apparent division of opinion, the great majority of thinking men, interested in the permanent progress of the dairy industry, and seriously considering the physical welfare of the consuming public, look upon pasteuriza-

tion as a logical and essential part in the process of the production and handling of market milk and the manufacturing of other dairy products.

But while the dairymen, milk dealers and consumers who believe in the benefits of pasteurization of milk are to-day in the great majority, there are too many individuals who still persist in looking upon pasteurization with suspicion and distrust.

There are those who claim that all pasteurized milk is not free from disease germs, and who point to unscrupulous dealers who sell so-called pasteurized milk for the purpose of defrauding the public. It is true that there have been and that there unfortunately still are some shiftless and unscrupulous individuals and firms who offer for sale so-called pasteurized milk, in the manufacture of which all principles of thoroughness and sanitation are ignored. While such milk is no better and no safer than the ordinary run of raw milk, these scavengers of the milk business are after all in the great minority. They are the exception and not the rule. Their fraudulent use of the word "pasteurized," however, can be no reflection on the true value of properly pasteurized milk, and because of a few black sheep we should not condemn the whole flock.

Others claim that pasteurization is not a complete protection against disease because it fails to destroy the spores of micro-organisms. Here it should be clearly understood that the usual germs of milk-borne diseases do not form spores, and that the destruction of spores does, therefore, not enter into the problem of rendering milk safe.

It is now generally conceded that the holding process of pasteurization, in which the milk is heated to 145° F. and held for twenty to thirty minutes, is by far the most efficient process which guarantees freedom from disease germs and at the same time does in no way impair the cream line. The continuous or flash process at higher temperatures falls short of maximum germ killing efficiency because, if temperatures were used in this method high enough for the maximum destruction of germs, the cream line would suffer or disappear entirely.

When the milk is not pasteurized in the final container the greatest care also should be exercised to guard against recon-

tamination of the milk after pasteurization and before it is sealed in the consumers' package, — the bottle. This means clean pasteurizers, pumps, conveyors and bottle fillers, clean and sterile bottles and caps, machine capping instead of hand capping, etc. When in-bottle pasteurization is practiced the danger from contamination after pasteurization is largely removed. When the pasteurization and packing of milk is regulated and supervised by State and municipal health officers, as should be done and as is now being done in most of the larger cities, these details are largely taken care of. The time has passed when pasteurization can be justly termed a mere makeshift, or, as others have said, an unreliable remedy for an uncertain danger.

Another very popular objection to pasteurization has been that it puts a premium on slackness and shiftlessness in the production and handling of milk, and that it therefore results in a postponement of the day when clean and pure milk shall arrive on our markets. This is a time-worn argument, and it represents a fabric largely of the theorist. While there may have been isolated cases when it applied, experience has shown it to be largely illusory; what happens to the milk after it leaves the farm is of very little concern to the average milk producer. The chances are that he does not know whether his milk is subjected to pasteurization or not, and even if he did, such knowledge would not induce him to modify his way of handling. Again, milk that has not received the proper care on the farm often cannot be pasteurized at all, because such milk does not survive the process of heating and would not be marketable after pasteurization. For this reason pasteurizing plants are automatically compelled to use greater care in the inspection of their milk at the platform, than dealers who do not pasteurize, and milk unfit for pasteurization is rejected.

Another objection frequently heard is that the heating destroys the lactic acid bacteria which in reality are beneficial, and that putrefactive types of bacteria are left intact, which, when relieved from the restraining action of the acid bacteria, develop and form products injurious to health. Mr. Rogers of the United States Dairy Division has done some very extensive work along this line covering a period of seven years,

and has found that, while this objection may have been true in the earlier days of pasteurization, when very high temperatures were used, milk pasteurized at lower temperatures, such as 145° F. with the holding process, as now is almost universally practiced in market milk plants, sours normally and in a similar manner as raw milk. This shows that enough of the lactic acid bacteria survive to remove this objection. My own experiments on pasteurization of cream, conducted during the last five years at Purdue University, further show that the putrefactive germs are killed at the same ratio as the lactic acid bacteria, and that properly pasteurized cream is, therefore, much freer from these undesirable germs.

It has been further argued that pasteurization does not destroy poisonous products already present in the milk before pasteurization. While this is perfectly true, it is equally true that pasteurized milk is no worse than raw milk in this respect inasmuch as these products are obviously also present in the raw milk.

Another very widely argued claim has been that pasteurized milk is less digestible than raw milk; that the soluble albumen becomes insoluble; that part of the ash, and especially the valuable lime salts, are precipitated; that the casein is altered in its physical make-up; and that the enzymes which aid in digestion are rendered inactive. These changes do occur, to a limited extent at least, in milk heated to temperatures near the boiling point (212° F.). But the fact that they do take place does by no means prove that they render milk less digestible. Comparative experiments, conducted by nutrition experts in this country and abroad with babies in hospitals and also with calves, dogs, cats, rabbits, rats and other animals, do not uphold these assumptions. In fact, the bulk of the now available evidence on this subject is favorable to the digestibility of pasteurized milk. Even the precipitation of the lime salts by heat does not render the mineral matter of the milk less digestible, the lime in the heated milk being utilized, digested and assimilated quite as well as the lime of normal raw milk. The important protein compounds of milk, such as the amino acids which are so essential for the growing child, and the presence of which in milk places it above all other foods

at equal cost with reference to its ability to stimulate growth, both of the bony and muscular structure, are not affected by heat; they remain entirely normal and unchanged. I say, even if these changes of the physical and chemical properties of the milk constituents do occur, it does not necessarily follow that the milk so changed is less digestible than raw milk.

But these changes are possible only when heating to temperatures near the boiling point. Boiling milk and pasteurizing it are two different processes. Boiling is not pasteurizing. Pasteurization as now understood and practiced refers to heating to 145° F. and holding for twenty to thirty minutes. At this temperature these changes do not occur, or, at the most, only to a very slight extent, nor is the activity of the enzymes at this temperature destroyed. Pasteurization properly executed, therefore, does not impair the digestibility of market milk and does not render such milk less suitable for infant feeding.

Commercially the greatest objection to pasteurization of market milk has been that the pasteurized milk loses its cream line. Since the consumer judges the richness of the milk largely by the depth of the layer of cream that forms in the neck of the bottle, and since many families desire to use that cream separately on the table, by pouring it off the top of the bottle, the cream line is a commercially important feature that cannot be overlooked. Its absence loses trade. The fact that pasteurization at temperatures near the boiling point does cause the cream line to disappear has led to the popular conclusion that all heating diminishes the cream line. This is erroneous. Heating to very high temperatures does retard, if not destroy, the formation of the cream line. This is an established fact. But heating to 145° F. and holding for twenty to thirty minutes does not diminish it, but actually enhances its formation, and tends to produce a deeper cream line if anything. This point was experimentally demonstrated by Dr. Burri of Switzerland, whose results conclusively showed that up to 145.4° F. the cream line formed more rapidly and was deeper than in the raw milk of the same batch.

The reason for this lies in the well-known fact that heat destroys the viscosity of the milk. It makes milk more fluid.

The greater fluidity gives the fat globules greater freedom of motion. They encounter less resistance in their upward passage, and, true to the law of gravity, they promptly rise to the surface, forming the cream line. The reason why, at higher temperatures, — those above 145.4° F., — the cream line fails to form rapidly, and possibly entirely disappears, must be attributed to the fact that at temperatures above 145.4° F. the albumen begins to coagulate abundantly, and this coagulation, though invisible to the naked eye, hinders, or entirely blocks, the upward passage of the fat globules. They do not come to the top and the cream line does not form.

In order to preserve the cream line, therefore, the milk should be heated not to exceed 145° F., and the temperature of the heating medium should be but a few degrees higher, otherwise the milk that comes in direct contact with the heating surface may be exposed to heat sufficiently high to damage the cream line.

There are other more or less incidental factors which influence the cream line, such as the nature and amount of agitation to which the milk is subjected, the nature and age of the milk, the period of lactation, etc.; but these are local details, and can be taken care of locally in the case of each individual plant.

With a clear understanding of these simple facts and principles, therefore, it is obvious that the proper pasteurization of market milk does not destroy nor retard the cream line, but that its formation may actually be enhanced by it.

Summing up, then, it is reasonable to state that proper care in the handling and production of milk minimizes danger of infection, but that no amount of care can insure the public against infection of the cleanest milk from unrecognized carriers of disease. While milk from private dairies, kept under most ideal conditions, often does surpass in quality, though not necessarily in safety, milk from the average pasteurizing plant, the pasteurizing plant furnishes a far safer product than the average private dairy and milk peddler.

Pasteurization, properly executed, is an efficient and practical means to protect the consuming public against the danger from infected milk. It makes possible the commercial handling of

large volumes of milk which is necessary in order to supply the consumer in our large towns and cities. It impairs neither the wholesomeness, digestibility nor the marketable properties of the milk. It retains all the important advantages and benefits, and is free from the dangers of raw milk. Pasteurization furnishes to-day the most logical, practical and workable solution of the perplexing problem of supplying a safe and wholesome market milk to the ever-increasing population in our towns and cities.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 69.

January, 1917.

CO-OPERATIVE DAIRYING.

E. L. BRIGHAM.

From the Sixty-fourth Annual Report of the Massachusetts State Board of Agriculture.

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Rear view of plant of Richmond, Vermont, Creamery Association.

CO-OPERATIVE DAIRYING.

E. L. BRIGHAM, COMMISSIONER OF AGRICULTURE, ST. ALBANS, VERMONT.

The dairy industry is, generally speaking, of fundamental importance in a system of farm management suited to New England conditions. The dairy cow can turn the grasses growing upon our rough, uncultivable pastures into a marketable product; she aids in upbuilding soil fertility by returning to the soil in manure a large proportion of the plant food we feed her; and she furnishes to farmers and their men during the long winter season employment yielding a steady income. When we consider, also, that the farms of New England are but a few hours' distance from populous, consuming centers which make the best markets in the world, there is every reason why our dairy industry should steadily develop and prosper.

The final test by which any business stands or falls, however, is the test of profit. If the business yields a return sufficiently large to pay all costs, including interest on money invested, depreciation, raw materials, labor, etc., together with a profit, it is called a satisfactory business; men are attracted to it, the spirit of success prevades it, and those who are engaged in it are proud of their calling. On the other hand, men are driven from the non-profitable business, and everything connected with it has an atmosphere of discouragement and discontent.

There seems to be a feeling among dairymen at the present time that their industry is not a profitable one, as judged by the standards I have indicated. Granting that this be true, what are we, who are interested in this business, going to do about it?

Nowadays, when a business is in trouble, a man called an efficiency expert is called in to study the business with a view to instituting reforms which will lead to a decrease in the cost of production. Have we done this in dairying? For a quarter of a century or more agricultural experiment stations have

been maintained in the several States for the purpose of making scientific investigations of agricultural problems. These stations in our northern States have found out and told us much about better methods of dairying. We know how to breed, feed and care for dairy cows better than we ever did before. We have adopted the silo pretty generally, and the growing of clovers, to cut down the cost of the ration. Furthermore, in order that records of production and feed costs might be kept of each cow, and expert advice be had about feeding, we have formed co-operative cow-testing associations. In 1914 we had in Vermont 25 of these associations which completed the year, and which made it possible to obtain the records of about 13,000 cows. These records ought to give us an inkling of the profitableness of dairying. The cows under test averaged to produce 5,087 pounds of milk and 230 pounds butterfat, and the feed cost was $45.76. But there are sources of income other than milk or butterfat, and other expenses besides feed. I asked two representative dairymen to go over the figures with me and make an estimate of the other items which go upon the debit and credit side of an account with a dairy cow. We agreed upon the following as conservative: —

Dr.		Cr.	
Feed,	$45 76	5,087 pounds of milk at 1.48 cents,	$75 28
Labor,	24 30	Manure,	15 00
Interest,	3 60	Calf,	2 00
Taxes and interest,	88		
Depreciation,	8 00		
Barn rent,	5 00		$92 28
Bedding,	1 50	Loss,	5 84
Keep of bull,	2 00		
Incidentals,	1 00		
Cost of keeping records,	1 00		
Hauling milk,	5 08		
	$98 12		$98 12

Now we must bear in mind that these cows were fed under the directions of cow testers who have had training in scientific feeding. In many of the older associations the poor cows have been weeded out, so that we may assume, I believe, that

these figures are fairly representative of what good Vermont dairymen are doing. I believe the figures for income show the case better than it is, because I have applied the average price for the year, although, as you know, the largest milk flow is in the spring months, when the prices are well below the average given.

Figures taken by Dr. Lindsay, director of your Massachusetts station, show a higher cost of producing milk in this State, and a larger loss. Dr. Warren of Cornell, in an address before the New York Dairymen's Association, as reported by "Hoard's Dairyman," stated that, charging labor at 20 cents per hour, it cost on the average $2.57 per hundred to produce milk in Delaware county, while the price received was $1.65 per hundred.

Some of you will say that these figures are wrong, because you know of many dairymen who are making money, paying for farms, accumulating savings bank accounts, etc. I answer that this does not prove my reasoning false. The labor of caring for dairy cows usually comes before and after what is a normal day's work for every other class of people; therefore the labor cost is cut down. A farmer may raise hay and grain at lower prices than the market price for which he could sell them; he may possess some capital, so that his interest charge does not have to be paid out of pocket. If these items are disregarded one can figure money in dairying. But such items are not disregarded in figuring costs by the handlers of milk or by any other business concerns in the country. If a farmer puts in sixteen hours a day he should have pay for his overtime. He is just as much entitled to interest on capital invested as is the milk contractor, the manufacturer or any other class of business man, and he is entitled to receive the market price for raw materials which he uses in his business.

When farmers begin to figure and reason in this way they see the necessity of not only lowering the cost of production, but also the necessity of better prices for dairy products, which means better marketing. We have seen within the year the feeling of indignation and wrong felt by dairymen over the prices they are receiving break out in a series of milk strikes in several places in the eastern part of the United States. These

strikes have undoubtedly served a good purpose; the producer's side of the milk question has been brought before the general public, the dealers have been taught a wholesome respect for the producers, and a temporary increase in price has been received.

It is the opinion of many people, however, even of some of the strike leaders themselves, that the question of better marketing of dairy products will not be permanently settled by strikes, but by co-operative action based upon the fundamental principles of better marketing.

The problem of marketing dairy products is, after all, a plain business proposition. On the one hand, we have the consumer demanding dairy products in the form of milk, cream, butter, cheese and ice cream. This makes the market. On the other hand, is the dairyman, with his supply of milk to dispose of, in such a way that he will get the highest possible price for it.

Milk and cream are comparatively bulky products of a perishable nature, which makes it necessary and economical for a city to draw its supply of them from a near-by territory. The fact that milk is used for infant feeding, and is a good carrier of disease germs makes it subject to stringent regulations by city boards of health.

Butter and cheese are less bulky, and of a less perishable nature, so that they may be transported long distances in good condition at small cost. Therefore we find our great consuming centers of New England and New York drawing their milk supply from territory as near the city as possible, going back a little further for cream, and getting butter and cheese at greater distances, even as far away as New Zealand, which is halfway around the world. In the case of all these products we find that the consumer pays a somewhat wide range in prices as the quality varies from poor to excellent. We must bear in mind, also, that the price of butter and cheese must necessarily bear a certain relation to the price of milk, because if the price of milk is much higher than its value for butter or cheese making, additional supplies of milk usually made into these products will be attracted from the territory farther back from the city. In Vermont, in 1914, we made 20,000,000 pounds of butter. If

the price of milk should rise much above the value of the butter which could be made from this milk, plus the value of the skim, much of what is now made into butter would be shipped to the city.

We must take into consideration that certain things must be done to move dairy products from the farmer's door to the consumer's table, and that these things cost money. Milk and cream must be delivered by team or auto truck to a central plant, where they are processed so that they will stand shipment without spoiling, and so that they will meet the requirements laid down by city boards of health. If butter and cheese are made, these products must be manufactured.

After they are processed or manufactured at the plant, dairy products must be placed on the train, transported to market, and there handled by various middlemen to the consumer's door. In many parts of New England milk is loaded on the train directly, and the processing is done in the city. Since the consumer will increase or decrease the amount of dairy products he consumes according to the quality and the price he has to pay, I believe it is important for every dairyman to get the view that he is interested, from the standpoint of his own pocketbook, in making the cost of getting his product from his own door to the consumer's door just as low as possible.

The system of marketing dairy products which obtains at present requires of the producer the least possible expenditure of thought and effort; in fact, the dairyman is simply and solely a producer. The milk contractor is expected to furnish cans, in most instances to collect the milk from the farmer's door, transport it to the railroad station or the plant, arrange for its transportation to the city, process it and distribute it to the consumer.

The contractor is expected to take any and all milk offered him, whether the quality is good, bad or indifferent, and regardless of whether the supply is equal to the demand, or the demand equal to the supply. There has grown up in many of our States, and there is gradually but surely growing up in others, an almost absolute dependence upon the milk contractor to perform all the operations connected with the marketing of milk from the time it leaves the farm until it reaches the con-

sumer. Conditions which have obtained under the leased car system of transportation, and the old rate system, made it more economical for the contractors to divide territory rather than compete with one another in the same territory. Therefore, except in some of the larger dairy centers of New England, dairymen have but one contractor doing business in a single city to whom to sell their product.

I have nothing to say against the milk contractors. There are all kinds of men in the business, ranging from good to bad, just the same as there are in farming. I do say, however, that it is not sound economics or sound business for a great industry like dairying to be absolutely dependent upon one set of middlemen to move dairy products from the farm to the market, with the ability to fix the price, as is now the case. The time has come for the dairymen of New England to formulate a declaration of independence, and to take such steps as will make that declaration mean something.

What are we going to do? The day has gone by when the product of the individual dairyman, unless he be doing a very large business, can make an impression in the city market. This is a time of big business in agriculture, just the same as in other lines. The small farmer may be the most efficient producer, but he will lose out in marketing his product unless he combines his product with his neighbors, so that a marketable volume of a standard product may be assembled and offered for sale. Co-operation among farmers, difficult as it is to bring about in New England, is a necessary step before we can improve conditions.

The necessity for co-operation seems now to be pretty generally conceded. Where shall co-operation begin, what shall be the work of the organization, and how shall one community link itself to other communities are fundamental questions pressing for wise solutions at this time. Co-operation, in my opinion, should begin in the local community, among dairymen who have a similar problem, — viz., to obtain the highest possible price for dairy products. The program should include not only the collective bargaining through a board of directors for the highest possible price, but also the production of fine-quality products on the farms of its members, and the hauling

of these products to the railroad station, or, wherever the number of cows is sufficient, to a central plant owned and operated by the organization, where the milk may be processed so that it is marketable in any city, and where in times of surplus it may be manufactured into butter or cheese.

When such steps are taken the dairy products of the community may be offered for sale to the highest bidder, and bids may be solicited from dealers in all cities within shipping distance. In this way the highest market price which the product will command may be received without the periodical friction which is bound to arise if the organization tries to force one dealer to pay the price which it thinks should be paid. In short, I would have the dairymen, through their co-operative organization, assume the responsibility of that portion of the process of distribution which the contractor now performs in the country.

The Richmond Farmers Co-operative Association, Inc., of Richmond, Vermont, has just perfected an organization which may be used as an illustration. The steps taken in the formation of this organization were as follows: —

1. A survey of the community.
2. The organization of a co-operative corporation.
3. The sale of stock.
4. The building of a plant of sufficient capacity to take care of the milk of the stockholders.
5. The employment of skilled help to receive and process the milk.
6. The offering of the processed product for sale to the highest bidder.

A survey was taken of 228 farms. It showed that these farmers owned 4,200 milch cows; that 85 per cent. of them sold cream, 10 per cent. of them sold milk, and 5 per cent. made butter at home. It also showed that these farmers obtained some income from the sale of hay, apples and live stock; that 95 per cent. of the number had milk houses and put up ice, 50 per cent. were interested in cow-testing associations, 85 per cent. owned their farms, 80 per cent. were American born, 48 per cent. owned automobiles, and 45 per cent. carried checking accounts in the bank.

Stock to the amount of $10,000 was sold to 30 farmers at a par value of $25 per share, 1 share being issued for each five cows.

The creamery company was incorporated under the co-operative law of Vermont, which enables one person to hold not more than 10 per cent. of the capital stock, and limits dividends to 6 per cent.

Plans for a plant were agreed upon after consultations with representatives of the Federal and State departments of agriculture. Representatives of these departments were also consulted concerning all the plans of organization, management, etc.

The plant was completed and opened for business about the middle of November, 1916.

Let us contrast the position of this community now with that which obtained before this plant was built. These farmers were selling their milk individually to the Borden Condensed Milk Company at a price fixed by that company. If these farmers had formed an organization, and sent a committee to Boston or New York to try to induce another buyer to come into the territory, the buyer would have reasoned something like this: "The territory at Richmond is occupied by one of the strongest concerns in the United States. If I go up there to buy milk I must erect a plant at an expense of at least $10,000, and I must enter into a fight with this strong concern now occupying that territory. Perhaps, after a large expenditure, I will be able to get only a small amount of milk. I see nothing in the proposition for me." On the other hand, equipped as they are with a milk plant, which is supposed to carry with it the product of the incorporators, an entirely different proposition is laid before the dealer. The farmers are able to say to the dealer, "After making a survey of the territory about Richmond we have formed a farmers' co-operative organization to build a milk plant which will handle the product of so many cows. We expect to have so much milk each month in the year. The plant belongs to us, and will be operated by our own manager. We do not ask you to invest a cent. We do not ask you to enter into a fight with the concern now occupying the territory, as we are going to do that

ourselves. All we ask you to do is to make us an offer for our product processed and standardized ready for market. If you want to bid on our milk or cream, or if you want a supply of fancy butter or cheese, give us a bid accordingly. We are ready to do business with the man or the concern which will give us the highest price for the fine quality of product which we intend to produce." The dealer will say to himself, "I will not have to make an investment in a plant. I will not have to enter into a costly and unpleasant contest for the territory. I am simply asked to bid on the finished product. I can afford to pay something for that," and he will. Forty different buyers from several different cities have made offers for the output of this plant. Sales are made to the highest bidders wherever they may be located, so that the highest prices are received. A new interest in dairying has taken hold of the community, and an addition is now being built to the creamery so that the anticipated business of next summer may be taken care of. The complete plant with contemplated additions will cost $18,000, a sum which would have startled the farmers a year ago.

If this plant is successful — and its success will depend simply upon good business management and the continued support of its patrons — the good will of the business will belong to the farmers of the Richmond community. It is said that the great Borden Company, which has for some years handled the product of that community, has issued, and claims the right to earn dividends upon, $5,000,000 worth of stock representing its good will and its label. That good will and label have not been worth one penny to the farmers of Richmond. If the Borden Company should conclude to move elsewhere to-morrow, it could do so without consulting a single one of its patrons. But the good will of the farmers' plant belongs to the farmers of Richmond, and will add value to their product and to every acre of their land. If these dairymen produce a superior quality of milk which is more valuable in the market, purchasers will offer higher prices in order to secure or retain the supply. If we could have in New England a number of plants like this one, which could furnish a constant supply of fine-quality milk, I am of the opinion that instead of being dis-

tributed by a few large dealers, the milk of our cities would be distributed by a number of small dealers who would make a specialty of handling milk produced in a certain community, the quality and cleanliness of which they would advertise.

Now as to the relation of communities. When we have a number of such plants it will be feasible to form a federation of plants having similar conditions of production and marketing, in order to hire expert service along those lines which would not be possible for a single plant. In time it might be possible for such a federation to go into the business of distributing milk in the city, but such an enterprise should not be attempted until there first is laid the foundation of success in the fundamental lines of production and preparation for market. Permanent improvement of conditions, in my opinion, will come by evolution and not by revolution. I believe it to be the duty of our agricultural agencies to ascertain by careful study the steps necessary to be taken in this gradual process of evolution which will lead to better marketing conditions, and, having decided upon what steps are necessary, not to fail to advocate them because the path seems hard and the goal slow of attainment. The world of business proceeds in accordance with certain economic laws. Great corporations have succeeded because, through a form of co-operation, small units, each having the same end in view, have united to accomplish these ends. I know of no great corporation which has succeeded without first producing a standard product and then taking the necessary steps to place that product in the hands of consumers in the best possible form and at the least possible cost. I believe that the dairy problem of New England will be solved only by co-operation among dairymen to attain the same end.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 70.

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MARKETING MILK AND CREAM.

E. L. BRADFORD.

FROM THE SIXTY-FOURTH ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

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MARKETING MILK AND CREAM.

E. L. BRADFORD, GENERAL MANAGER, TURNER CENTER DAIRYING ASSOCIATION, AUBURN, MAINE.

A prime consideration in any market question is preparation of the goods for market. We have all been shown graphically in a leaflet issued by the Massachusetts Dairy Bureau the comparative value of milk with other common articles of food. I was asked by a producer only a few days ago why it is that milk with its high food value and comparatively low cost is not in greater favor and more generally consumed? I think perhaps it is in part because it has not always gone into society as any one else would who sought to be a favorite, — namely, in spick and span, clean, fresh condition. The manner of producing and handling milk at the dairy governs, to a large extent, its final desirability and worth. Cleanliness and liberal use of ice are indispensable. But I for one have thrummed this tune for many years, and it is indeed refreshing to note that the Producers' Association has caught up the refrain, "Better prices for better milk." Let works accompany the words, that they be not "as sounding brass or a tinkling cymbal." Our concern will meet the producers 100 per cent. of the way in their endeavors for better prices for better milk. Better milk would bridge over a sea of troubles in the dealer's life. We would gladly pay to the producer every penny saved or gained through better milk.

I do not belong to the Producers' Association. I doubt whether I am eligible. But "Barkis is willin'." The wicked socialist believes in co-operation of all interests, not in co-operation of one interest to oppose another. The socialist calls this latter thing "war," — an irrational, stupid thing. But do not listen to the socialist lest you too have an iridescent dream, — selling milk at auction and raising in New England all the

milk, cream, butter and cheese consumed in New England, — plus the nightmare of selling milk by the can without regard to test.

I feel consistent in saying that in the present condition of society and commerce I know of no better way of marketing milk than the one pursued by the association to which I belong, subject at all times to such improvements in detail as may be suggested. If I knew of a better way I should be after it. It will, then, be proper for me to set forth our methods of marketing milk for the producers.

In imitation of the great Cæsar, I will divide the duties of our concern into three parts, and in true orthodoxical and paradoxical fashion the last shall be first.

First. — Obtaining a fair market price for the milk.

Second. — Financing and conducting the operations from producers to consumers.

Third. — Distributing to producers their fair share of the proceeds.

Making the selling price is perhaps the highest responsibility the milk dealer assumes. One casts about to see what others are selling milk for, — what the market price seems to be. This is not the easiest thing to be determined. The situation is pretty well known and needs no comments from me. Then you take into account the present and prospective supply available; also, if you are a large dealer, you think about the substitutes which are in competition with your milk. The moral effect on the consuming public of insistent demands from producers for increased returns is a very important bracer for your price maker. When the matters are all gone over you have got to make your decision. Our association manufactures butter and casein from its surplus cream and skim. For 1916 the pounds of butter made were a little short of a million, while the pounds of casein were a little short of half a million. This, of course, is the least profitable part of the business; and for this reason we pay a smaller price to producers or small dealers who turn over to us only their surplus, and have no milk for us when we need it most. The trade we cherish is for cream, milk and skim milk. In making a price list I like to have the prices of these articles entirely consistent throughout, — a composite

price, so to speak, of the fat and skim. It is fair, and will go to place the price of fat in cream and milk somewhat above its value for butter making. Then the price of skim will be made such as to attain the desired rate for milk of the test which you are selling, or rather, which you are trying to bring out by blending the various grades which come from your producers. In another paper to-day I have vented my spleen over the useless law which compels us to go about blending or standardizing in the awkward, unscientific way we are obviously obliged to do. When the prices have been established per pound of fat and per hundredweight of combined skim and fat, any one can make out our price list for any desired per cents of cream, milk and skim or buttermilk so that all grades will be of consistent prices. Any one can have our price list by applying for it. Before leaving this important part of my subject I want to call attention to certain things that must be taken seriously as substitutes for fresh cream, milk and skim milk. When cream is short at certain seasons and in the hot spells of summer, the ice-cream maker gets on nicely with "Homo," — a product of sweet butter (unsalted) and skim milk, put together by a homogenizing machine. If skim milk is short, one-half skim may be used and the rest made up with skim powder and water; or, indeed, the product may be made wholly from sweet butter, skim milk powder and water. In fact, this product is so smooth and satisfactory that some ice-cream men prefer it to use all the time, even when straight cream is plenty. Fresh milk is in competition with condensed milk. Fresh skim milk has for a competitor condensed skim milk and skim milk powder. Some bakers prefer the powder on even prices. With these conditions in view the New Eng-England producer may well be careful not to go too far in his demands.

The second division of the milkman's duty — financing and conducting operations from the producer to the consumer, — affords plenty of watchful working and exercise for prudence and judgment.

As evidence that this service is performed in good faith at minimum cost, the distributor should not hesitate to publish the cost and selling prices and the classified operating and

other expenses. This applies, of course, to cases where the dealer handles milk of producers, paying them "what he is able to," or, as some people inconsiderately say, "what he sees fit to pay." Contracting for milk six months in advance is and always has been a very bad practice. No responsible concern would care to do so unless at a low price. The milk market is and properly should be open to all producers of good milk, and there is little more reason in contracting for six months in advance than in buying the crops of wheat, cotton or potatoes before they are planted. If the dealer publishes his operations as above suggested he will be open to criticism on three points, — first and second, the selling and buying prices may be criticised by opposing interests; and third, the costs of operation may be criticised by both these interests. If these three matters are kept within reasonable limits, why is not such a business commercially sound, — worthy of the support of buyers and sellers? From some things we read or hear said one might think, and probably many do think, that the milk dealer's business is to take 10 cents a quart from the consumer, pay the railroad a fraction of a cent, return to the producers 4 cents or so, and pocket about one-half of the proceeds. I would not take any notice of this stuff except that it too often comes in pretty strong solutions from people who ought to know better. No doubt there is poor management. We know there is, and we are constantly trying to improve it. Once in a while we get a suggestion made in good faith and calculated to be helpful. Such suggestions are gratefully received whether of any value or not. But the greater part of the criticism aimed at milk dealers is untruthful bluster.

Our association retails comparatively little milk. Our bottle milk is sold chiefly to retailers.

We have no smart ways of bribing the buyer or the chef or the janitor, or doing any such things. The price we sell our goods for we get, — generally cash when the sale is made in case of all the smaller deals. Employees are taught from the beginning that the first principle of good business is integrity, and that is what will be expected of them in all dealings with our customers. We have no use for cunning, tricky methods.

For the advancement and security of our business we make

a moderate reserve fund, just as savings banks are required to do by law. I want to briefly allude to the plan of farmers owning plants with a view to contracting with the highest bidder. That may be worked out successfully in some cases, but my belief is that it will not be generally successful. That is too long a story to go into here.

The New England Milk Producers Association seems to take a firm stand upon standardization. I like that wherever applied. Standardization of *method* of price making (not of price) to producers would be very helpful, and would show all sections of New England where they "were at." We would like to join in such a plan provided our method was adopted.

Our plan of price making to the farmers is the last and easiest of our duties. Why not? It is just a matter of bookkeeping. We pay the operating and other expenses first, and pay the farmer what is left. We have a file of annual reports running back more than thirty years which support the statement. The only criticism or objection I have heard to our expenditures is on the dividend we have paid to employees for the last few years. Some farmers thought it should have gone to themselves rather than the employees. My opinion and explanation of the matter has generally been satisfactory to such producers. For three years we have made dividends to the producers, in 1912, 1913 and 1916. The patrons' dividend for 1916 has not been paid yet, but it will be 5 to 10 per cent. (we hope the latter) of what they were paid in June, July and August. In those months we bought large amounts of butter and eggs from outside sources; also made and sold large quantities of homogenized product. This was not speculation, it was stuff for which we had a sure market. All the profit from these sources went into the general business, and the farmers profited by it, or will do so as soon as we make the dividend to them in a few days.

In making prices to producers we consider the market requirements. If a large amount of milk is likely to be called for, as in the fall, — particularly in November and December, — we make the price "per hundredweight" higher to encourage as many as possible to bring along milk instead of cream. When milk is in oversupply, as in the spring and early summer, so

that we have to make skim into casein, — a less profitable use of it, — we cut down the price per hundredweight, and then the more distant patrons will send in only cream and feed the skim, which is not worth much more than the cost of hauling to the factory.

Another thing we do which may or may not be right. In the flush season, when milk seems to be made more cheaply, we intend to hold back a small margin to help out the price when the supply is scant. The object is to encourage a more even production, avoiding the unprofitable surplus and having the milk when customers greatly need it. Having a goodly supply in the short season really helps the man who produces mainly in the flush season, for you can only expect to have such customers in the flush season as you can carry through the short season. For this reason we are obliged more and more to protect our steady patrons against the practices of some who will leave us when we need them and want us to take them on when we do not need them, — when they are a positive setback to the business. There are customers of a similar sort who will apply when milk is short and drop us when the supply is plentiful. We are now keeping a card file on those sellers and buyers who would use us only as a convenience. Our plan is, on the one hand, to pay butterfat price only, — no per hundredweight, and, on the other hand, to sell at retail price, if we have the goods to spare. We never indulge in the reprehensible practice of taking goods away from a regular customer to sell at a premium to some one else.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 71.

January, 1917.

THE OXFORD BEARS FRUIT GROWERS' ASSOCIATION.

E. E. CONANT.

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E. E. CONANT, MANAGER, MAINE FRUIT GROWERS' EXCHANGE AND OXFORD BEARS FRUIT GROWERS' ASSOCIATION.

I think perhaps the best way to begin my talk is to tell you something of the conditions among farmers in Maine. They are about the same as in any other section of the country. While the agricultural prosperity, as measured in terms of production, is equal to that of any part of the country, little effort has ever been given to placing the products of the soil on the market in any businesslike manner. Generally speaking, the farmer disposes of his crops in the same hit-or-miss fashion as is common the country over.

Several years ago conditions among the apple growers in our locality were especially bad. Nearly all of the crop was disposed of to local buyers who made their own price. This price the grower had to accept or let his apples rot in the cellar. Under this method the farmers were bidding against one another, always working to their disadvantage, and playing into the hands of the buyers. When a lot of apples consisted of several varieties, the price was usually fixed at the figure offered for the least desirable kind. The grower would sell to the buyer who would pack the largest number of barrels from the lot, throwing out as undesirable the smallest number. This, of course, resulted in a very low standard of packing. The few farmers who consigned their apples to the commission houses in the cities were no better off. Ignorance of commercial practices and market conditions resulted in the returns being no better than for apples sold to the local buyers. Cases are on record where the transaction resulted in a complete loss. The returns received for apples disposed of under this system — or, better, lack of system — were so meager that it is little wonder that the trees received only casual attention. There was little in-

centive for a man to prune, spray, cultivate and generally improve his orchard when he could receive little more than the cost of production no matter how good his fruit.

It is not my purpose to enlarge upon conditions. Most of you are familiar with the case of the farmer as an independent unit, without knowledge of conditions, trying to sell his crop. I shall, rather, try to show you what one small body of men have been able to do through organization. The first step in advance came with the appearance in our State of representatives of English receivers of apples. These men were desirous of getting Maine apples on the foreign market, and competed with the local buyers for the crop. One house in particular sent its representative into our section year after year, encouraging the farmers to export their apples, and pointing out the possibilities of the foreign market. It was customary for these English houses, through their agents, to advance to farmers a certain amount per barrel, usually as much or a little more than the local buyers were offering. The apples were then shipped in the farmer's name, to be sold on commission by the receivers across the water. After making the sale, account sales were made up and returned to the growers together with remittance for whatever the apples net over and above the advance. The individual farmer in exporting his apples was at a disadvantage, and often fared as poorly as his neighbor who sold to the local buyer or consigned to some domestic commission house. In passing I may say that the apples put up for export were packed rather poorly, and were not a good advertisement for Maine apples.

At the same time, well-graded and packed fruit when exported gave the farmer very satisfactory returns. The main thing for which we have to thank our English friends is that they opened our eyes to the possibilities of a market across the water. Owing to the fact that only large growers were able to make up car lots, the smallest unit economical to ship, it became customary for several of the smaller ones to get together making up a shipment. While there was no attempt at organization, this was a step toward co-operation.

In the spring of 1911 a young man from our town took advantage of the opportunity to attend a short course in fruit

growing given at the State college at Orono. There he learned, among other things, of the successful operation of the well-known co-operative associations in the west. He came back with wonderful stories of how these organizations were overcoming the obstacles of distance and unfamiliarity with market conditions, and were handling crops so as to return the grower a profit sufficient to encourage the growing of better fruit. The young man began by interesting his brothers in a scheme for better marketing. On numerous occasions there were lively discussions, and it was finally decided to form a co-operative society with seven brothers as charter members. This was in the summer of 1911, and marks the beginning of the Oxford Bears Fruit Growers' Association. Much valuable assistance was given us by the State Department of Horticulture through Mr. S. K. Gardner, the State Horticulturist, and Mr. G. A. Yeaton, assistant. From the success attained by the organization it is apparent that from the start the founders were on the right track. The chief essentials for success in co-operation were present, and I wish that you would mark these few necessary things.

First. — As shown by existing conditions, the association was born of necessity.

Second. — There was a sufficient supply of fruit being grown in the neighborhood to assure us of enough business.

Third. — It was possible for us to hire as manager one having some knowledge of marketing.

Fourth. — Most important of all, I consider, we had as members men possessing the true co-operative spirit, a progressive outlook, and a willingness to stand back of the organization through thick and thin.

We incorporated our association under the laws of our State, with a capital stock of $1,000, this being divided into 200 shares at $5 each. Each grower subscribes to 2 shares of stock upon being elected to membership. This entitles him to vote at all meetings of the association. Only matters pertaining to the general policy of the association are voted on in the regular meetings of stockholders. Most of the business is transacted by the board of directors, in whom we place considerable responsibility. These directors are five in number and are chosen

annually. Only two new ones may be elected at any one time. This board elects the officers of the association and hires all of the employees, fixing their compensation. One of the most important things that the directors do is to determine how the fruit shall be packed, and they have full power to reject any lot not considered up to the standard. Since so much depends upon the board of directors, we are very careful in choosing them. As these men practically give their services, receiving only $1 for attendance at each meeting, they must be men unselfish, broad minded and alive to the interests of all the members. We have always been able to secure the services of men of this sort.

After organization the first thing to do was to define exactly the place and purpose of the association. As set forth in our by-laws, our object is threefold.

1. To secure to the fruit growers of Oxford County and vicinity all possible advantages in marketing their fruit.
2. To build up a standard of excellence.
3. To create a demand for the same.

Our aims are not confined to these few things, however. Broadly speaking, the purpose is so to co-operate in our business that we may not only render valuable service to our members in every way, but that we may also, by setting an example, help in establishing a better community spirit.

We early recognized the necessity of establishing a name for ourselves. We began by selecting a name for our organization which should be distinctive and at the same time representative of our section of the country. After choosing the name Oxford Bears Fruit Growers' Association, we immediately set about to design a trademark by which our brand should be known on the market. This trademark appears on the label in every barrel and on every box of apples packed by the association. It stands for *quality first,* the phrase we have taken for our motto. We have never had a special appropriation for advertising. We believe that honestly packed fruit placed on the market under a brand name will advertise itself. Our experience has borne out the truth of this statement. The label and what it stands for have been enough. One thing that has enabled us to establish a name for ourselves is the making up

of car lots of seasonable varieties. By this, I mean that at a certain time, when a variety is in prime condition, we are able, by drawing on the various members, to make up a car lot, thus securing the minimum freight rate. The individual grower, in order to make up a shipment of desirable size, has to hold some varieties until they are somewhat past season. Association apples can be shipped in proper season to meet market demands. The fact that our association apples are on the market year after year keeps the buyers on the watch for them, and they know what to expect. An individual's apples may be ever so good, but if the brand is unknown the price will be less than that realized by those with a reputation. To illustrate this point I will say that this year we started in early to export our apples. From the middle of October until the Christmas holidays nearly every boat docking in Liverpool had in its cargo one or two cars of Oxford Bear apples. The buyers were expecting them, and were willing to pay a premium of two shillings per barrel or more for them. Almost invariably we received a cable after each sale, "Sold Oxford Bear apples absolutely top of market." It is with no small effort that we have built up and maintained our reputation. Insistence has ever been made that all fruit put out under our name should be honestly graded and packed strictly according to law. Our manager is ever on the alert, and the packers are carefully watched to see that their work is done as well as possible. Of course, it is impracticable to inspect each barrel of apples put up, and the packers, being human, sometimes err. However, I will say that we have so far succeeded in maintaining our standard that we have seldom received a complaint and never have had a shipment turned down. Frequently our apples are sold at auction or private sale without showing a sample, solely on the reputation of the Oxford Bear brand. When cars for export are shipped we cable a variety list to our English receivers, and frequently the apples are sold before landed at a premium of two to three shillings over the top prices realized at auction for the same varieties on the same sale.

One of the chief things our manager does is to make a careful study of the market. All information as to crop conditions throughout the country is obtained early in the season. This is

supplemented about harvest time by reports of crop movement and prices on various markets, together with cold-storage reports and all other information available. We receive the market report issued daily by the United States Office of Markets and also the Canadian Telegraphic Report. These we find of great value. With all of this information at hand we are able to form a good idea of crop conditions, and know something what to expect for prices.

Since it has always been customary for our people to export a large percentage of the crop, we have been particularly interested in every bit of information obtainable as to conditions in England. Most everything we knew prior to 1913 came to us through the representative of our English receivers. In the fall of 1913, however, it was decided that it would be worth a great deal if our manager could see for himself just how apples were handled on the foreign market. Accordingly, plans were made for the trip. As I was at that time manager of the association, it was my pleasure to make the trip. About 600 barrels of Oxford Bear apples were on the same steamer with me. Before leaving home I had seen these apples harvested, packed and loaded into the cars, so I knew just what they were like. I was now to follow them through the whole process of marketing. I was met in Liverpool by the representative of our English house who had so often visited me at home, and whose guest I was during my stay in England. Under the guidance of this man I was shown the ins and outs of the Liverpool, Manchester and London markets. On the docks in Liverpool I met the same apples I had seen so carefully packed. They were being inspected by the buyers there on the docks, and I had a chance to note in just what shape they arrived. Some few of them I noted were slack on account of faulty coopering. This put me on my guard, and since then more care than ever has been given to coopering, the result being a very small percentage of slacks. For several hours at a time on two or three occasions I sat in the auction room where apples were selling. I also had a chance to meet many of the fruit brokers and large buyers, as well as a number of retailers. From personal observation and conversations with these men I was able to gain more of an insight as to market demands, preferences, and so forth, than I

could have learned in several years' reading up on the subject. Most important of all, I learned that the English buyers are able to distinguish between an ordinary apple and a well-graded and packed article, and that they show this by their willingness to pay more for the latter sort. We have not, however, been interested solely in the export market. For several years our manager has made a trip to Aroostook County in our own State, and has succeeded in building up a nice little business there. A number of cars were placed there this fall.

I will now attempt to tell you a little of the actual operation of our association. Early in the fall, at the time crop reports are coming in from various sections of the country, the manager puts in several days visiting the orchards of the members. He notes about how large a crop and what varieties and quality each will harvest. By a careful estimate he is able to tell somewhere near what the crop will be, — how many hundred barrels of Baldwins, Greenings or other varieties he may count on, and how they will run as to grade. At this time, also, he gets a better idea of price by talking with the growers.

As the apples are harvested, crews are organized to do the packing. These men are hired for the season and paid so much per day and board. The association pays the packers, charging their time to the growers at cost, and they are boarded at the expense of the men whose apples are being handled. A crew usually consists of three men, one of whom is foreman. Each crew is provided with sorting tray, barrel press, baskets, stencils and other things necessary for packing. In addition to the regular stenciling, consisting of variety, grade and association name, each crew has a number of its own to go on the barrels. This is for the purpose of identification in case any fault is found with the barrel. After stenciling what is to be the face end of the barrel it is turned over, and before the pulp-head is put in, one of our barrel labels is placed in face down.

Our system of loading cars for shipment is as follows: we do not pool our varieties and grades for the season, but rather on each sale. By this I mean that every grower receives the same price for No. 1 Baldwin, No. 2 Greenings, or whatever the grade may be. Of course it happens under this arrangement that one

man may receive a different price for apples of a certain grade than his neighbor whose apples go to another sale. To counteract whatever difference there may be, we try to be as fair as possible, dividing up the shipments, and plan never to have all one man's apples on a single sale, but to split them up. Perhaps I can best illustrate this point by showing how it has worked out this present season. Early in the year, before any one could tell what turn the foreign market would take, we sold several cars at very good prices f. o. b. shipping point. As it happened, apples exported began to bring unprecedented prices and we wished that we had shipped everything we had. However, the orders taken early had to be filled, so to average things we loaded a certain part of each member's apples in export cars, and a certain part in those cars sold for a cash price. We use a card in keeping a record of shipments. For every car shipped one of these cards is made out. These are copies of actual records in our office. We find them very convenient in keeping our accounts correctly. A proper and well-ordered system of accounting is very essential to the success of any business, and is particularly desirable in the case of a co-operative society, where the records are open to inspection by the members at any time.

After the apples are hauled to the cars for shipment the individual member has nothing more to do with them. The association looks after the whole business of marketing. It attends to the billing, invoicing, tracing of cars, and, in short, everything pertaining to shipping. It also, in the case of export stuff, sees that space is obtained on the best steamers to the most likely markets. The association also collects all moneys from the sales, paying the grower for apples delivered by him. We have always found it well to keep our members supplied with money during the season, paying them on account from time to time. We are able to do this because of the prompt manner in which money comes in from our sales. Immediately upon consummating a sale, the foreign agents make up our account and cable the amount due us to our credit at the bank.

It has never been our policy to increase our membership merely for the sake of having our amount of business look big.

We have thought it best to limit our growth, keeping it healthy and within manageable limits. At the present time we have 30 members. Since organization we have returned to our members nearly $100,000. This present season we shall handle nearly 8,000 barrels, and return the members $30,000. One thing we think remarkable. In doing this large amount of business we have never lost account of a single barrel or box, and *what is still more remarkable,* we have never lost a cent in bad bills.

While the most important achievements have been in the marketing of our crops, we have also been able to save our members considerable by purchasing supplies co-operatively. We buy fertilizer, lime, spray materials, barrels, head liners, pulp-heads and other materials in large quantities, thus taking advantage of discounts. Last spring, by immediately accepting an offer, we saved $60 on a ton of lead arsenate.

At Hebron Station, our shipping point, we have built a storehouse one story high with about 2,800 square feet of floor space. This building we have found very useful both in shipping season and for the purpose of storing supplies we have bought. This season, when the car shortage was troubling, our members were able to keep right on hauling their apples and putting them into the building. Then, when a car or two was sent in, it was an easy matter to hustle the apples out of the building and into them.

One of the activities of our association is its winter meetings. These were formerly held at the homes of some of the members, but now at the storehouse. The meetings take the form of a general discussion of any matters of interest in the growing or marketing of fruit. They are held monthly and serve to keep up the interest through the winter. All of the Bears turn out for all day. The wives of our members provide a lunch, and a general good time is enjoyed by all. Our biggest get-together is the annual field meeting. This event is held in the summer time in the orchard of one of our members. It is widely advertised and every one is invited. We have had an attendance of as many as 500 at one of these meetings. We have been very fortunate in obtaining speakers, and have had some programs of exceptional interest.

I have now told you at some length of the main activities of our association. There are a good many interesting stories connected with its life that I would enjoy telling you if time would allow. It is sometimes said that success is made up of failures. In our six seasons of activity, all has not been easy sailing. Mistakes have been made, but they have not been serious mistakes, or, at least, we have discovered them in time to correct them.

In closing I will say that I attribute what success we have had to four things.

First. — We have had leadership, not of a few, but of many, as manifested in the true spirit of co-operation.

Second. — We have always employed a good system of accounting.

Third. — The board of directors and the manager have always been businesslike in their methods.

Fourth. — All-important, square dealing has formed the cornerstone of all our business.

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MARCUS L. URANN.

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BUSINESS ORGANIZATION AS RELATED TO AGRICULTURE.

MARCUS L. URANN, BOSTON, MASS.

We cannot hope in a single talk within the time allotted to present more than a few points of this important subject. If, however, there occurs to some of us during this hour an idea which may later develop, ripen and bear fruit to the benefit of the industry, or to any branch of society, which draws so much of its life from the country, then we will know this hour has not been wasted.

Organization in commercial lines is quite generally understood and accepted, but its application to agriculture is a comparatively new and untried field. Our physical and natural conditions have contributed to keep it so; even our form of government has resulted in disseminated rather than centralized development.

Our system of marketing and transportation of our various crops, not only in the different parts of the country, but even in the same section, makes the subject more difficult. Then, too, our people come from every known part of the globe. Some sections are peopled by like races, having similar appetites and habits, while other sections are composed of a mixture of people, whose methods of living are widely different. Therefore each particular market must receive special consideration to determine what it wants, when it wants it, its appearance, quality and condition. Add to this that many of our markets are changing and developing, so that he who would organize to supply a given market must not only consider the change in quantity of goods, but, far more difficult still, he must anticipate the changing appetite and needs of a developing population.

These varied conditions mean increased expense to supply all of the various tastes encountered even within a small area, and

requires an efficient service expensive to maintain. Just how far we can regulate and control the development of market taste has yet to be determined, and is one of the great questions for a business organization.

Organization is simply the recognition of certain definite and well-fixed principles, their segregation, proper use and application to the particular industry under advisement. It is the natural way of doing things.

In organizing the United Cape Cod Cranberry Company we desired to secure the administrative purchasing and selling advantages of being large while still retaining personal ambition and ingenuity, to accomplish which the property of the company was divided according to location into given areas, over each of which a superintendent has control, with the same authority that he would have as owner of the property. He keeps a monthly report showing what is done, why it is done and the result. The superintendent himself determines his conduct and measures his success by these reports.

Another obstacle to organization is the business success of the average farmer during the last twenty-five years. True, the feeling is quite general that he is not receiving his fair percentage of the profits from our industrial system. Perhaps, too, he is beginning to realize that legislation which he sought has not proven the panacea expected, for too often laws passed at his behest have contained riders at the request of some influential organization, who saw through him an opportunity to obtain an advantage or secure protection. Nearly always the laws are a compromise. If his law could give the expected relief, it often failed because of administration. It seems a fact, reckoned with by every one except the farmer, that in some way the politicians appear to have charge of the administration of most laws, and they have the uncanny desire to hold their job, to insure which so much of their strength is exhausted that they have no capacity to sympathize with the spirit of the law, or gain the information necessary for its success. The good man (and there are a lot of them in politics) cannot depend upon the support of an unorganized class of farmers.

Capital has combined until its ramifications extend in such a network around the world that it is a unit, and if affected in

any particular place, like the blood of our body, relief rushes from all sections.

Our railroads, street railways, express companies, refrigerator car companies, cold-storage plants are organized with such combination and vision that any industry less organized is at a distinct disadvantage in doing business with them. We think in terms of organization, of large units, lacking which an industry has little respect and no consideration. This is a time of giants. The single tree from the forest will float, but a thousand trees combined make the giant ship to combat storm and gale, defy the ocean's tempest and carry a Nation's trade according to the will of the master.

Inventions are so related to agriculture, and the manufacture and distribution of farm machinery so well organized, as to take tribute from the farmer if desired. This business is obliged now to follow such methods of selling as to materially increase the farmer's cost of doing business.

Labor is organized until it can dictate to the highest bodies which govern us. In the face of all these tremendous movements the farmer still tries, single handed, to combat these organizations, which are determining the course of trade and swaying governments and thrones.

Agriculture has a definite place to fill in the economic development of the world. It is a wheel to the wagon, but whether or not it fulfills its destiny, or, failing, destroys the other great organizations, depends upon the farmers themselves. The farmer needs organization, also, because he has not the capital to distribute his crop, to give necessary credits, or properly develop markets. He lacks not only this financial strength, but also the ability of specialized selling agencies, in harmony with which he is not now fitted to work.

After adopting an organization the next step is to determine how it works, to accomplish which use a simple method of accounting. This will show that certain sections of even the same farm will produce a better quality of some goods than of others; that some sections will produce in greater abundance even the same crop than other sections; that for various reasons, physical or otherwise, some sections can be cultivated at greater economy than other sections; that methods of doing the same work

must be changed in different sections. The expense of production, quality of product, shrinkage in storage and market results known only by accounting determine what crops should be continued and what avoided.

It is sad to learn how lightly accounts are regarded, when often the apparently unimportant detail, lost to memory, determines the success or failure of a whole season.

In commercial lines we can try experiments fast, — our results are soon determined. In agriculture, however, work is by season, often permitting but one experiment a year, and extended over a period where accounts and records are absolutely essential.

The farmer's attitude is not surprising, for he has been born and bred to depend upon himself. His own personal judgment determines his crop, its planting and cultivation, harvesting, packing, as well as when, where and through whom to market.

These conditions not only convince us that organization is needed, but with other facts, now to be mentioned, prove this an opportune time to present in some sections, in some degree, a concrete plan.

Our natural resources are quite, if not entirely, used or exhausted. Our soils have lost their virgin richness. The hundreds of saw and grist mills operated by water power along our streams, and which, because of their number and distribution were no small factor upon which the farmer could depend, have now been starved by exhausted raw material, or crushed in the battle of competition with other great forces. No one is justified in producing what he can buy cheaper than he can raise.

The farmer feels his lack of business training and experience as never before. Observation and the printing press have opened his eyes to what is being done in special lines. The farmer feels his responsibility and opportunity to feed our people, who are becoming yearly more and more helpless to feed themselves. People are crowding into cities with no opportunity to produce. The first generation soon forgets, while following generations never acquire the knowledge to use the soils. A larger percentage of our people are annually becoming workers in factories and distributing agencies, living under conditions which preclude storing a surplus food supply. The squirrel lays by his winter stores, but man individually depends with almost

criminal unconcern upon others for the necessaries of life beyond his immediate wants. True, cold storage, canning and other methods have developed within the last few years, but the farmer is the final bulwark of safety, and only his neglect has permitted these agencies to develop and absorb the profits which rightly belong to him. We can, however, overorganize. There are two ways to destroy the value of the farm to society, — first, overorganize or commercialize it; secondly, let it fall so far behind in the industrial race that those interested in it, or upon whom its future depends, quit in contempt or discouragement. To avoid such a calamity the first requisite is an ideal, a vision of the great opportunity furnished by agriculture to do something worth while, the success in accomplishing which depends upon the quality and amount of brains, skill, cunning and hard work employed. The farmer should himself show a higher respect for his business.

The first great product of the farm is the home, the great source of stamina and moral fiber, the source of that undescribed but definite something influencing a man to shape his life by a principle; here is developed ingenuity and inventive genius, as well as a wilful determination to succeed and the physical strength to sustain.

The farm, however small, should be organized in detail as a solid business unit. Buildings should be so placed in relation to each other and in view of the duty to be performed so that time, labor and investment will be reduced to a minimum.

Build in proportion to the business. Avoid a $1,000 barn for a $100 crop. Watch details. Avoid waste. Seek a balance in the various departments. The barn, shed, outbuildings and house should have such a relation to each other in size and convenience as to perform their functions at proportionate expense.

There are three classes of farmers, — first, the farmer of necessity, who has inherited a farm, and cannot get money enough to leave it. He has not the stamina to let go of the old ideas and undertake new methods, nor to play the long game, either because he does not know it or can not afford it. Necessity compels a crop for which his place is often not adapted and seldom prepared. Thus the industry is injured and his children ill fitted for a place in society.

The second class are farmers of entertainment; they may be retired business or professional men, or men yielding to the desire to become producers, or who, for diversion, start a country place and become the laughing stock of the community.

The third class actually makes a living from the farm. Hard-working, self-denying, training the children for some other business, he keeps his knowledge to himself.

Now of these three classes we should expect nothing from the first, the third is too occupied, but the second one, the center of jest by the rural population, viewed with suspicion by the city men, unclassified by the agricultural school, is really the man upon whom our hope rests, for he has the ideal and the courage to live for it. By business experience he is better fitted to consider the problems, and financially able to put his conclusions into effect. This man just needs to realize his responsibility and the great opportunity outspread before him, and to be regulated and directed.

Agriculture needs, as never before, to be dominated by a comparatively few men; they must be leaders in foresight and energy. But in no industry is it so necessary for success that the organization is understood by all, entered into by all and the profits shared by all.

We are growing too many crops without organizing the community itself, including standardizing the crop and product. The attempt has been made to immediately put on agriculture an organization, equipment and efficiency which commercial lines, though lending themselves more readily to organization, have required years to accomplish.

The farmers have reached no extremity; they are not in a fit of the blues, nor are they in the last ditch of despair. The fairly intelligent man has succeeded and will continue to succeed without an organization, but every man will succeed better if organized, and agriculture as a whole can occupy its true position and fulfill its service to society only by organizing.

Select your neighborhoods in which to start; it will be many years before any agricultural organization, however desirable, will be universally adopted. In determining the location remember that necessity alone must be the force to draw these people together. This is not abandoning the higher ideal, but

recognizing the necessary tools by which alone that ideal can be accomplished. Let this community determine what crops it will raise, to decide which it is necessary to know the needs of the proposed market, means of transportation, the competition likely to be encountered and the nature of the soil to be worked.

Frequent crop reports from competitive sections will help the producer to determine the time of developing his crop to the best advantage to both himself and the consumer. The word "competition" is used advisedly, because that must be reckoned with for some time yet. As a matter of fact, there is no place for competition in a properly organized industry, and especially in agriculture.

There are so many people, and they will eat so many potatoes, so much wheat, corn and other food products. Agriculture, when organized, will know what sections can best produce a particular crop, and, with proper advice as to the area planted, there should be no surplus, no waste, no duplication, and our producers would avoid attempting something which more complete or advanced information would have shown them could result only in failure.

The next step in the organization is neighborhood or community equipment. It is seldom in this section of the country at least that any one farm is conducted on a scale permitting an economical equipment, although our production cost can be greatly reduced by using the machinery which modern invention provides.

With your community standardized as to crop, you could then have a community department of labor, just as the city has its fire apparatus, sewer department, etc. The expense of this universal equipment would be comparatively small to the individual, and the work conducted by a special crew trained and experienced for a particular service could be accomplished more effectively and at less cost than in any other manner. Frequently it costs as much to tone up the machine before using, and pack away after using, as it does to do the work. Under this plan this item would cost no more for many farms than for one. Also it frequently requires some time for a crew to readjust itself to a new job. All of this expense would be saved.

There should be a community department of construction and repair; its workshop should be centrally located and specially fitted and stocked for general repair work of tools and equipment in stormy weather, and in pleasant weather it should attend to the repair and construction work of the community, beyond the farmer himself in ability or equipment.

The matter of spraying for crops as well as weeds will be much more effective if conducted by a crew especially trained for that service, gaining economy in equipment, materials and labor. This plan will tend to a good equipment for a few crops instead of a poor equipment for many.

There should be community storage. It is folly to expect each producer will, can or should provide suitable storage for his crops; the cost is unreasonable, prohibitive and wholly unnecessary. It can be easily determined over what period a crop is likely to be marketed, and central storage facilities provided at comparatively low cost to the individual. Every man is vitally interested in this matter, for his product, under the present system, must come in direct competition with similar goods stored, packed and transported under all kinds of favorable and unfavorable conditions.

Community storage will likewise change what is now a loss into a profit. On every place, however large or small, there is always a surplus of fruit or vegetables, which at present are being wasted because not in sufficient quantity to market. With central storage these small lots will, together, be an amount worth shipping.

At this central house should be community packing. To properly pack a commodity of any kind is a fine art, and to pack for different markets requires special knowledge of the conditions at destination, as well as the distance and means of transportation.

This central packing house will also help to remove a thorn from the flesh of the producer universally referred to as "the middleman's profit."

Without defending any one I wish to say that much of the expense between the producer and consumer is due not to the abnormal profits or dishonesty of any one handling the goods,

but to the system itself, much of which can be saved by the method advised, and the chance of dishonesty greatly reduced.

Having the storage houses the producer will keep control of the goods, so that there will be no reported sales on a rising market or delayed sales on a falling market. No plan has yet been devised to successfully avoid the middleman, and it will be far wiser to work with him. Few commission houses have facilities for handling and keeping the goods under favorable conditions. The producer's storage facilities should be used by the brokers, saving rent, repacking and clerical work, as well as quality loss. They would have a larger stock from which to select and less competition among themselves, at least, the competition would not center around the goods being sold, but would be based on service rendered. It will save self-competition. Very frequently a shipper will send goods to several brokers in the same market, and thus they are bidding against each other on his goods. Fill the broker's order from the storage house nearest the purchaser.

A purchasing department should be located at this central packing house. A trained buyer will save his expenses several times over, even for a small group of farmers. Buying in bulk is a small item compared to finding stock articles to replace specialties, or to finding a ready-made tool for a particular service.

The next step is joint shipping, which, properly developed, will save freight, breakage, packing, loss in transit and avoid a surplus in any market. There are distinct advantages in quantity shipping. Many producers desire to distribute their crop during the entire season, or have less than a carload, or after loading have a remainder, in all of which instances, by uniting with other producers, as can effectively be done only with a central packing house, it is possible to match lots so as to load a car of the same grade and quality of product.

At present, and probably for some time in the future, shipments will be made regardless of like goods sent to the same market from other places. The individual shipper cannot afford the expense, nor has he the facilities to watch shipments, but the community department can keep closely in touch with the various markets within his reach, as well as shipping points, so

as to know when, where and what class of goods should be shipped, as well as determining the time required to reach consumption. This will materially affect the expense in packing.

Another great advantage is the use of by-products. No producer but that at times has a perfectly good product and always a second quality which, for various reasons, cannot be marketed to advantage. It is a very small community that cannot support a preserving plant, permitting spare time or unused land to be utilized with distinct advantage.

So far we have considered only the cold-blooded business aspect of the situation. Necessity makes a man work just to supply his need. Beyond this it must be higher motives. Few work for money. It may not seem so, and possibly the man himself may not analyze his motives, but generally the pleasure of doing things, the zest of the game, is the force driving him to invention, sacrifice and work, and if he has no room to employ this energy, resting in some degree in the breast of every human being, either his spirit is broken or he seeks a new field.

What a wonderful opportunity organized agriculture presents to train and direct the push and energy of youth. If agriculture will keep at home some of the jobs which can be done in the country, but which as now organized are located in the city, these back-to-the-farm, rural-life, crowded-city and depleted-race questions will be solved. In accomplishing this do not forget that a social department is a vital thing to a country business organization. Man is a social being craving the society of men, and he prefers those of his own experience and ideals; he wants entertainment, but unknowingly will choose that best fitting into his life, and his amusement will naturally be from topics which his training and experience enable him the most easily to comprehend.

This branch of the organization should include schools, both trade and business, preparing him for his work instead of the university.

This is the proper department for sanitation, nursing and clinics dealing especially with children's diseases. There should be physical training with gymnasiums, shower baths, bowling and other games, as well as military drill.

The proper agency to successfully undertake this part of the organization is the church, weak now because its time is spent in prayer and praise, without criticising which it may be suggested that faith without works is void, and the demand now is for community service and public welfare. You should every one support the church, preferably from the highest religious motives, but, if necessary, because of business necessity. Its history, standing, motives and foundation principles, universally acknowledged, make it the only agency to successfully accomplish these social benefits.

The business organization, departments of labor, storage, packing, supplies, etc., naturally tend to centralize the country neighborhoods, giving the church an opportunity never before enjoyed.

After organizing the individual community there should then be established warehouses in the large markets, the most important one of which should be the head of the institution, in instant contact with every branch house, from which it could direct shipments of surplus stock to the nearest market having a demand. The local houses will, of course, first satisfy local need, the surplus then being sent to the point of demand. I venture to say that farm products have been sent from the vicinity of Springfield to Boston, with consequent cost of storage, packing, transportation and commission for selling, and returned within a short distance of the man who raised it.

The entire organization advised cannot be immediately adopted, and its success does not depend on universal acceptance either in plan or area. Each community, being a single unit in itself, may adopt as much or as little of the plan as desired. It can likewise work in harmony and to advantage with other communities similar or less organized, and as time passes, with other sections seeing the advantages obtained by the organized communities and feeling the pressure of their competition, the system will spread, and as it extends it will be developed and more completely adopted until finally agriculture will take its place as one of the large organized units in our modern industrial system.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

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POTATO GROWING IN MASSACHUSETTS.

S. C. DAMON.

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POTATO GROWING IN MASSACHUSETTS.

S. C. DAMON, RHODE ISLAND STATE COLLEGE, KINGSTON, RHODE ISLAND.

Introduction.

Any one who is at all interested in the subject of potato growing, whether it be for home use or for market, cannot help being forcibly impressed with the importance of the industry and the great need that exists of increasing the yield in Massachusetts. A visit to the large potato-growing sections of the State will help one to more adequately appreciate the extent of the business and the importance of the crop from an agricultural standpoint, and yet if one were to take a trip to the potato yards of the railroads in all the large cities of the State, where carloads, and at certain seasons of the year trainloads, of potatoes are received daily, the fact would be more forcibly impressed on his mind that the potato is one of the most important articles of human food grown upon our farms to-day. The further fact is also plainly evident that but a small part of all the potatoes consumed in the State is grown within her borders.

There were grown in Massachusetts in 1914, according to the United States Bureau of Crop Estimates, 27,000 acres of potatoes, producing an average yield of 155 bushels per acre, or a total of 4,185,000 bushels, which, at 71 cents per bushel, would have a total value of $2,971,350. Assuming as a conservative estimate that the State has a population of 3,500,000, and that the average annual consumption of potatoes is 3 bushels per capita, there are needed annually 10,500,000 bushels, or two and one-half times the quantity produced at present.

This situation shows that the needs of the State are large, and that the supply for the market must be constant and practically inexhaustible. This explains why potato growers

from Florida to Maine are constantly seeking the markets of the State, and why early potatoes from the extreme south come to this market long before last season's crop from Maine has ceased to arrive. In fact, potatoes are coming from somewhere outside of the State practically every day in the year.

This introduction to the subject of potato growing has been written for the express purpose of emphasizing the fact that the business, from the growers' standpoint, is even less than half what it should be. Growers can with certainty double their acreage or preferably their yield, knowing full well that every bushel will be needed in the State. There is, then, every reason why a farmer should look with favor upon this branch of his business. He should certainly try to expand it, and supply from the farms of the State more of the potatoes that are consumed within her borders.

Why hesitate to engage in a business for which natural conditions are so favorable?

The soil in most parts of the State is well suited to the crop, the climate is favorable, enough rainfall can usually be depended upon to insure abundant growth, and above all the quality of the home-grown potatoes is usually far superior to those from elsewhere. There are always enough potatoes, but there is a large market awaiting every producer who can carry to it potatoes of a superior quality. The problem of the Massachusetts grower is, therefore, to so thoroughly understand the few essential points which insure both quality and quantity that he can come nearer supplying the real demands of his own market than at present.

The first essential in potato growing is a liking for the business and a determination to succeed, for this will insure a careful study of the subject and the proper attention to details, without which success is impossible.

At the outset one should provide himself with a set of potato machinery consisting of at least a horse-power planter, costing about $90, a horse-power sprayer, costing about $110, and a digger of the elevator style, costing about $125.

Add to this list a two-horse riding cultivator, costing about $75, and one has a set of substantial standard implements that will last through many seasons.

Soil and Previous Preparation.

For the best development of the potato a naturally drained sandy loam is always preferable to wet heavy soils.

The preparation of the soil by filling it with the desired amount of humus should have been the purpose of the farmer for several years previous to the season when potatoes are to be grown upon it. This is most important, for the humus not only assists in holding fertilizer, manure and moisture for the use of the growing crop, but by its decomposition it improves the tilth and supplies considerable quantities of plant food. The practice of growing a previous green crop to turn into the soil for its humus, or of growing a crop like grass which leaves behind a mass of roots and stubble, increases greatly not only the number of beneficial soil bacteria but, eventually also, the size of the potato crop. For the reasons just mentioned a well-planned rotation of farm crops is of the greatest benefit. The following are good rotations for a potato grower: three and four year rotations: (1) grain followed by rowen; (2) clover; (3) potatoes; or corn may come into the course before the potatoes, making a four-year rotation. A five-year rotation: (1) grain and rowen; (2) clover and grass; (3) grass; (4) corn; (5) potatoes.

The ground for potatoes should be well plowed, usually to the full depth of the top soil, even if it is from 8 to 10 inches deep. If green sward is to be turned for potatoes marked benefit will result from first cutting the turf thoroughly with a double disk wheel harrow. When the field is plowed a jointer colter should be used on the plow beam to insure the thorough burying of the sod. The final fitting of the ground by repeated harrowings is very important, and should be continued until the surface soil to a depth of at least 4 inches is fine and loose. The field is now ready, provided the planting is to be done with a machine which drops the seed and applies the fertilizer at the same time. If the planting is to be done by hand the field should be first marked so that the rows will be straight and evenly spaced, for this is essential to thorough cultivation and spraying later. The rows should then be furrowed 4 to 6

inches deep to receive the fertilizers and seed. Care should also be taken to mix the fertilizer with the soil in the furrow before the seed is planted.

Kinds of Fertilizers and Methods of Application.

The results of repeated and long-continued experiments have shown conclusively that the fertilizer should be compounded with reference to the needs of the potato crop. On all our New England soils, and Massachusetts is no exception, it is necessary to practice liberal fertilization.

The general practice is to grow the potato crop exclusively with the aid of commercial fertilizers, and to use the farm-yard manure for the preceding crop of corn.

A well-balanced potato fertilizer should contain all three of the essential ingredients: nitrogen, phosphoric acid and potash. The nitrogen should be supplied in nitrates, ammonium salts and organic materials because the aim should be to have a constant supply present in readily available form for the use of the plant during its entire growing period. Furthermore, if it is applied in several forms there is less danger of loss by leaching. The phosphoric acid content must be relatively high, because its function is to supply not only the needs of the growing plant but also to hasten maturity or the ripening of the crop. The percentage of potash should also be high, not only because the crop of tubers removes a large amount of it but because it is necessary in large quantities for building up the vines, and especially in the leaves, to assist in the formation of the starch, which is later deposited in the growing tubers.

The high-grade sulphate of potash is sometimes used because of its supposed beneficial influence on the cooking quality of the crop. In a dry season, however, the muriate of potash may give a larger crop; hence many successful growers prefer that at least a part of the potash be present as muriate.

The proportions of the different elements in a ton of fertilizer should be about as follows: —

	Per Cent.
Nitrogen,	$3\frac{1}{2}$ to 4
Phosphoric acid,	8 to 10
Potash,	7 to 10

A Massachusetts potato field in blossom. (By courtesy of the American Agricultural Chemical Company.)

Potato Fertilizer.[1]

At the Rhode Island Agricultural Experiment Station the following fertilizer has given excellent results: —

	Pounds per Acre.
Nitrogen,	60
Phosphoric acid,	120
Potash,	150

Made up as follows (home mixed): —

	Pounds per Acre.
Nitrate soda (nitrogen, 20 pounds per acre),	130
Sulphate ammonia (nitrogen, 20 pounds per acre),	100
Tankage (nitrogen, 20 pounds per acre; phosphoric acid, 21 pounds per acre),	270
Acid phosphate (phosphoric acid, 99 pounds per acre),	581
High-grade sulphate potash (potash, 150 pounds per acre),	300
	1,381

This is all applied in and along the sides of the furrows, thus distributing it in a space about 2 feet wide, and then cultivated in along the bottom of the furrow before the seed is dropped.

This extra stirring, while mixing the fertilizer and deepening the cultivated soil, is believed to be a very beneficial operation. The covering of the seed will further mix the fertilizer with the soil along the sides of the drill in such a way that the growing plants will derive their full benefit from it.

A crop of 300 bushels to the acre of potatoes will remove from the soil about the following amounts of fertilizer ingredients: —

	Pounds.
Nitrogen,	61
Phosphoric acid,	29
Potash,	104

It is therefore a rational practice to apply a liberal amount of fertilizer, knowing full well that any portion of it remaining unused by the potato crop will not be lost, but will be used in giving a vigorous start to the succeeding crop of grain or grass.

[1] As this article was prepared before the war, the remarks about the use of potash must be considered as modified by the present difficulty in obtaining it.

If ready-mixed fertilizers are used one should by all means buy a high-grade fertilizer containing 3.25 to 4.1 per cent of nitrogen, from 8 to 10 per cent of available phosphoric acid, and from 7 to 10 per cent of potash. This is for the reason that each pound of these ingredients will cost far less than if bought in the lower and cheaper grades of fertilizer. This fact is plainly evident when one recalls that it costs just as much to mix, handle, bag and ship goods which contain only half as much of these ingredients. The farther the fertilizer must be shipped by rail, and the longer the haul by team, the greater the saving by purchasing the higher grades. It is indeed surprising how persistently some growers cling to the purchasing of fertilizers which can be bought for from $25 to $30 a ton rather than pay $40 a ton or more for a smaller quantity of high-grade goods in which much more plant food can be obtained at the same actual cost. This continues notwithstanding the teachings of the agricultural experiment stations, the State Board of Agriculture and the fertilizer manufacturers, all of whom have urged persistently the greater economy of the fertilizers carrying the higher percentages of plant foods.

Treatment of Seed Potatoes and Planting.

In attempting to produce a large yield of potatoes it is important to select a variety which has well-known productive traits. Some kinds yield more than others under the same treatment; thus a variety of the Green Mountain type will yield more than one of the New Queen type. All good growers treat the seed potatoes before planting with a solution of formalin, 1 pint to 15 gallons of water; or corrosive sublimate solution, 2 ounces to 15 gallons of water, for one and one-half to two hours, to kill any germs of the scab disease which may be on the outside of the tuber.

After this treatment the seed is ready for cutting and planting. If an early crop is wanted the potatoes are treated by the last of February, and are then spread in the light to sprout. This may be done in direct sunlight or in a well-lighted room, and by planting time they will have developed short, strong, green sprouts, one-half inch or more in length. These become

so strong and hardy that they will bear the necessary handling incidental to planting without breaking.

If small potatoes are used, about 2 ounces in weight and from a known productive field free from disease, they may be planted whole with good success. If larger seed is used it is best to cut it lengthwise into 1 and 1½ ounce pieces having two good eyes.

The yield per acre, according to South Dakota Experiment Station tests, as described in Bulletin No. 155, increased with the size of the seed pieces. These ranged in weight from less than one-half ounce to over 4 ounces, and corresponding crops ranged from 175 bushels per acre to 299 bushels.

The seed pieces are usually planted not more than 15 inches apart in the row; sometimes thicker if on rich land, and very occasionally as close as 8 inches apart. The rows should be 33 to 36 inches apart, depending on the richness of the land. This requires from 12 to 22 bushels of "seed" potatoes to the acre. The general practice, however, is to use from 15 to 18 bushels to the acre.

Cultivation.

Good care and thorough cultivation pay with the potato crop. The cultivation should begin within a week after planting, by running the two-horse cultivator as deeply as possible between the rows, to be followed in a few days by the weeder, run in at least two directions. In another week or ten days run the weeder again, and every ten days thereafter until the potatoes are from 3 to 4 inches high. Then begin with the two-horse cultivator and continue with it at intervals of ten days, or until the vines cover the ground so completely that it is impossible to cultivate any more. Whether to hill up the potatoes or not depends upon the season and the nature of the land. In a dry season do not hill more than is necessary to furnish a good mound of mellow earth in which the tubers can develop. Much depends upon the soil condition being right if one hopes to secure a crop of smooth uniform tubers free from those defects caused by hard, lumpy soil. In order to appreciate the importance of this it is necessary to understand the potato plant, and to realize the necessity of having a deep mellow soil

for the roots to feed in, and for the stolons, which are the underground stems that bear the tubers, to penetrate. These stolons run out, on some varieties, a foot or more, and then the end enlarges and develops into the tuber that is dug and harvested.

Spraying.

Spraying must accompany the cultivation of the crop, commencing as soon as the vines are from 4 to 6 inches high.

The spraying early in June is chiefly for the purpose of checking the damage by the flea beetle, which sometimes punctures the leaves to such an extent that it not only checks the growth of the vines but gives the spores of early and late blight free access to the tissues of the wounded leaves.

From the last of June to the second week in July or later, spraying with a poison solution to kill the potato beetle is necessary. They must be kept off the vines by all means, for unless checked they will strip all the leaves from the stalks in a few days and ruin the field. The following is a good spray to kill the potato beetle: 3 pounds arsenate of lead in 50 gallons of water. This may be used alone or the 3 pounds of arsenate of lead may be put into 50 gallons of Bordeaux mixture.

Arsenate of lead is mentioned because it is very effectual in destroying the young beetles, and there is no danger of injury to the foliage as is the case with Paris green. If it is necessary or desirable to use the Paris green, use one-half pound to 50 gallons of water, and add 3 to 4 pounds of lime to prevent danger of leaf burn.

These poisons are used only for the purpose of protecting the vines from insect injury. Spraying with Bordeaux mixture must nevertheless be continued for the more important purpose of preserving the vines from attacks of the late blight caused by the fungus *Phytophthora infestans*, the worst of all enemies of potato vines.

The late blight is a fungous disease which may attack the leaves, and later the stalks, of the potato plant at any time in July or August. It first appears as a brown spot on the leaves, as large as a cent or larger, and sometimes it spreads so rapidly, if unchecked, that it soon covers all the leaves. They then

dry and fall off, the stalks wither and the crop is consequently ruined or greatly lessened. The best-known remedy at present is to spray the plants with the following: —

Bordeaux Mixture.

Copper sulphate (pounds),	4
Burned lime (pounds),	4
Water (gallons),	50

In order to make this mixture easily a stock solution should first be made. This is prepared by placing 20 to 30 pounds of copper sulphate in a cloth bag and suspending it in a wooden barrel containing an equal number of gallons of water. For this purpose a large kerosene barrel, with one head removed, is satisfactory.

In another barrel slake an equal weight of lime, adding, in all, the same number of gallons of water as was used in the copper sulphate barrel.

These stock solutions will keep almost indefinitely, and they are a great convenience when spraying frequently. In preparing the Bordeaux mixture for use pour into the spray tank 5 gallons of this stock copper sulphate solution and fill the tank about half full of water. Into this pour 5 gallons of the stock of limewater, and then nearly fill the tank with water. In order to learn if enough lime has been added to the Bordeaux mixture to neutralize the acid of the copper sulphate, a test should be made by adding to some of the mixture a few drops of a solution of ferrocyanide of potassium. If a dark precipitate appears more limewater is needed, and it should be added until no precipitation results. Having accomplished this the mixture is ready for use in the field.

The Bordeaux mixture should be applied with a horse-power sprayer equipped to cover five or six rows at once. A pressure of at least 60 to 100 pounds to the square inch should be maintained, or enough to cause the spray to be deposited as a fine mist.

In case a regular and thorough spraying is practiced every week to ten days, from the time in June when the potato vines are 6 to 8 inches high until the potatoes are ripe and the vines

practically dead, the yield is usually considerably increased over that on the unsprayed portion of the field, even during those seasons when the blight is not very bad. The late blight is likely, however, to be such a destructive disease that a potato grower should by all means spray as a regular part of his field operations.

Cost of Spraying.

For flea beetles and potato beetles use arsenate of lead solution, as follows: —

	Approximate Cost per Acre.
Arsenate of lead, 3 pounds at 7 cents,	$0 21
Water, 50 gallons,	–
Labor, man and horse, spraying,	37
Total,	$0 58

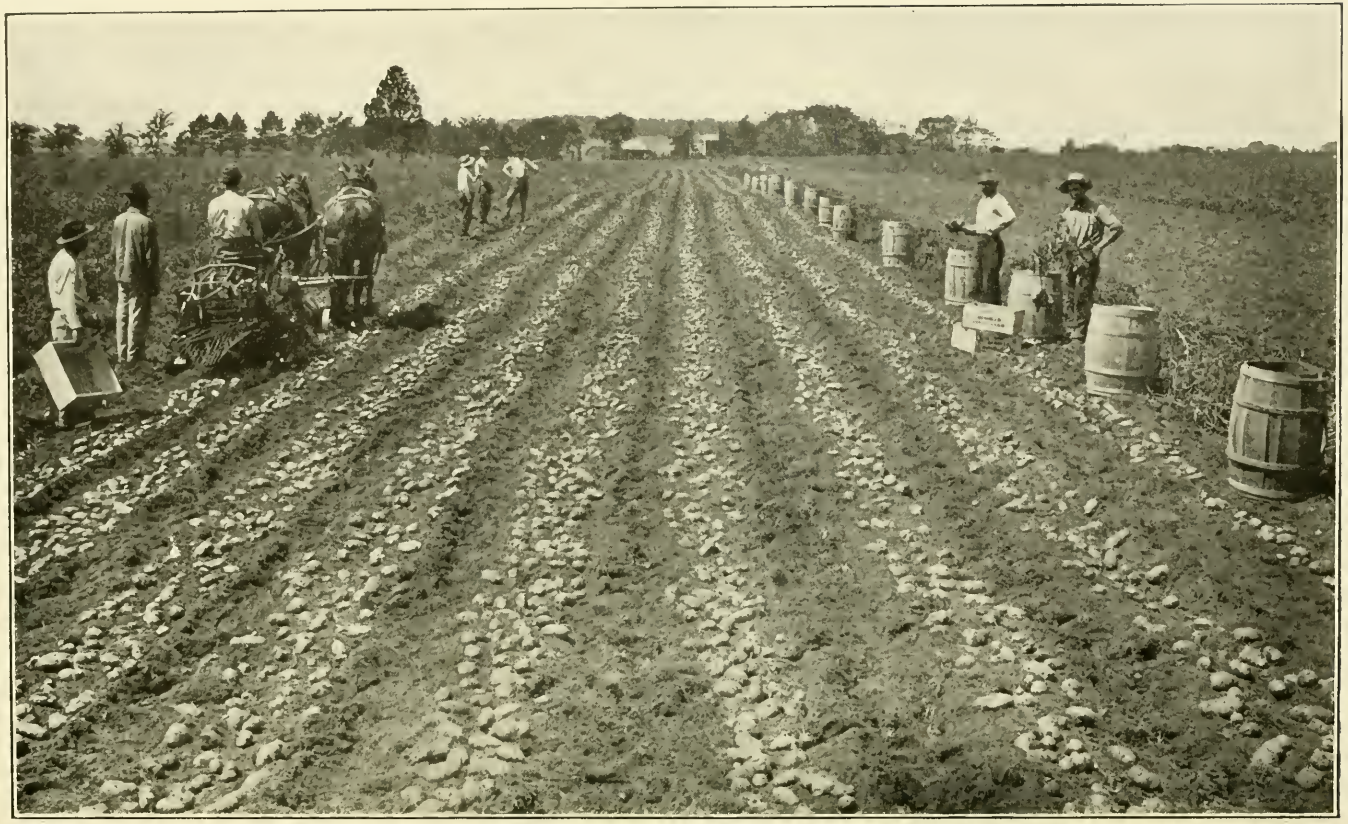
For blight use Bordeaux mixture, using the 4–4–50 formula, as follows: —

	Approximate Cost per Acre.
Copper sulphate, 4 pounds at 6 cents,	$0 24
Lime, 4 pounds at ¾ cents,	03
Water, 50 gallons,	–
Labor, spraying,	37
Total,	$0 64

If 60 gallons of Bordeaux are used to the acre one spraying costs about 70 cents, and if ten applications are made the total cost is about $7 an acre. For thorough spraying late in the season 100 to 150 gallons to the acre may be needed.

It is a common practice to use poison in the Bordeaux mixture when "bugs" are numerous. In such a case arsenate of lead may be used five times, costing about as follows: —

	Approximate Cost per Acre.
Arsenate of lead, 5 applications at 21 cents,	$1 05
Bordeaux, 10 applications,	7 00
Total,	$8 05



Potato harvesting in Massachusetts. (By courtesy of the American Agricultural Chemical Company.)

Experiments continued for ten years at the New York (Geneva) Experiment Station have shown that spraying increased the average annual yield of potatoes 97 bushels to the acre.

Harvesting the Early Crop.

On account of the high price which often prevails for a short time the early potato crop should be harvested and sold without waiting for the tops to become dry. When the early potatoes are of marketable size, and the price is high, it is usually best to dig them at once, even though the weight of the potatoes is no more than the weight of the vines. The increase in the rate of yield is, however, often very rapid after the middle of July, as is shown by the following results of experiments made at the Rhode Island Agricultural Experiment Station: —

July 11, first digging, 162 bushels to the acre.
July 31, second digging, 338 bushels to the acre; daily gain, 8 bushels to the acre.
August 5, third digging, 371 bushels to the acre; daily gain, 6 bushels to the acre.
August 12, fourth and last digging, 393 bushels to the acre; daily gain, 3 bushels to the acre.

Harvesting the Main Potato Crop.

As long as the vines in a potato field remain green and healthy it is certain that the potatoes are growing; hence it is the practice of many not to dig the main crop until the tops are dry and dead, showing that the crop is ripe. This is the ideal stage for harvesting because the skin of the tubers is generally set, and they can then be handled without material injury.

If only a few acres of potatoes are grown it is best to dig them by hand or to use one of the many plow types of diggers. These are sometimes of great assistance, but usually require more or less hand work to uncover some of the potatoes that have been buried by the plow. If a grower has a considerable acreage of potatoes it is usually profitable to use a digger of the elevator type, which requires four horses to properly operate it.

After digging, it is best to gather the potatoes as soon as

they have dried enough to insure that the soil will rub off in handling them. They can then be placed in the cellar in a clean, dry condition.

Storing Potatoes.

In storing large quantities of potatoes it is necessary to ventilate the storage room sufficiently to carry away the considerable amount of moisture which they continually give off.

The temperature of the storage house or cellar has a great deal to do with the condition and keeping qualities of potatoes, especially if they are to be used for seed stock the next season.

The best way to check the loss of moisture from potatoes during storage is to maintain as low a temperature as possible without having them actually freeze. This should usually be between 34° and 44°. Potatoes thus stored will go through the winter in prime condition and come out in April hard, firm and without a sign of sprouting.

Grading for the Market.

There is no part of the potato business which needs more attention on the part of the grower than the proper grading and handling of the crop for market. There is a rapidly growing demand for potatoes of superior quality, and if such a product is offered for sale in a style which will command attention the customer will become the grower's friend. What do I mean by this? Just this: in the first place, the potatoes that go into a first-quality package should all be uniform in size, free from disease and injuries. They should fully conform to the following conditions, which were prescribed at a recent conference, in Chicago, of potato growers, dealers, and representatives of the agricultural colleges and of the United States Department of Agriculture: —

First-class potatoes shall be such as are sorted over a screen, which shall be, for round white potatoes, $1\frac{7}{8}$ inches in the clear; are practically free from varietal mixtures, scab, sunburn, rot, mechanical injury or other defects serious to the consumer; and do not contain over 5 per cent which are over 12 ounces in weight nor which would go through the above screens.

Varieties.

Mention was made earlier in this article of the importance of planting the variety that will best serve the grower's purpose. The yield of different varieties, when planted side by side, may easily range from 150 to 350 bushels to the acre. The average yield in the State was 155 bushels to the acre in 1914, which was an increase of 50 bushels over the previous year, but the up-to-date grower will not be satisfied with a yield of less than 300 bushels to the acre. On good soil the Green Mountain type of potato, if the season is at all favorable, and the care and fertilizers approximate what has been described in this article, will usually give about such an average.

The early potatoes do not, as a rule, yield as many bushels to the acre, but this cannot be expected, especially if they are dug before they are fully grown, whether for the purpose of selling at the top price or in order to clear the ground for fall seeding.

Some attention should be given to the type of potato grown. The market demands are for one of regular oval shape of 6 to 12 ounces in weight, having a smooth, netted skin and shallow eyes. When the potatoes are cooked they should be mealy and dry; the flesh should be clear-colored and possessed of that rich flavor which only good soil and proper cultural conditions can impart. Quality, of which something has been said before, is not entirely an inherited trait, but is greatly influenced by the soil, fertilizer and climatic conditions existing during the growing season.

Potato Diseases.

There are so many diseases which attack the potato plant and tuber that one might be almost discouraged to undertake to grow potatoes at all.

It is not the intention to enumerate and describe all of the known fungous or physiological potato diseases, or to attempt to suggest remedies. The ordinary grower has not time to give to most of them. He bends all his energy to keeping them out of his soils and off his fields. He tries to use only clean seed, and by treating it properly to avoid those fungous

diseases which, like common potato scab, are transmitted by germs on the surface of the seed tubers. Again, he practices a rotation of crops so that potatoes never follow each other successively, and before they are planted again the field is devoted for some years to other crops. In this way the fungus left in the soil by the last potato crop may in some cases be destroyed or lessened.

A list of diseases of potatoes in this country would include at least the following: early blight, late blight, leaf blotch, sun scald, tip burn, brown rot, black leg, potato stem blight or rosette, potato wilt, potato scab, wort disease and internal brown spot. These may not be all, but they are enough to give one an idea that if potatoes are to be grown successfully, the grower must be prepared to practice "eternal vigilance." He must also take advantage of all the results obtained by the specialists on potato diseases and potato growing, working in the United States Department of Agriculture, as well as of the splendid work in experimental potato growing done by the neighboring experiment stations of Maine, Vermont and New York.

Again, referring to the potato crop in this State, we see that it stands next to the highest in total value, being exceeded only by the hay crop. What is there that offers greater returns per acre as a cash crop? It is one that fits into other lines, like dairy farming, with the best of results. Let the acreage of potatoes in the State increase!

The Commonwealth of Massachusetts.

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Common Potato Diseases and their Control.

A. Vincent Osmun.

From the Sixty-fifth Annual Report of the Massachusetts State Board of Agriculture.

Elizabeth Mooney

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COMMON POTATO DISEASES AND THEIR CONTROL.

A. VINCENT OSMUN, AMHERST, MASSACHUSETTS.

The potato is subject to some of the most destructive diseases affecting cultivated crops, and the losses are often very heavy. There are, however, definite and effective control measures for most of these diseases, and proper attention to them will not only reduce losses to a minimum but will often actually increase the yield. Diseases which attack the foliage are controlled by spraying with fungicides; for those which work on the tubers and stems other control measures must be applied.

The effectiveness of spraying potatoes depends on keeping the vines thoroughly covered with the spray material throughout the growing season. This is accomplished only by spraying at least three or four times in ordinary seasons, and in wet seasons at intervals of ten to fourteen days as long as the vines remain green. In a season of frequent rains and moderate temperatures the omission of any one of the applications may result in

FIG. 1.—Early blight. (After Farmers' Bulletin No. 91, United States Department of Agriculture.)

great loss from the late blight. Bordeaux mixture has proved to be the best fungicide for potatoes, as it will not only effectively control blights, but seems to have a stimulating effect upon the vines.

Early Blight. — This disease is caused by a fungus (*Macrosporium solani*) which attacks the leaves, producing dead round spots marked with distinct concentric rings (Fig. 1). It appears in July, usually before the late blight. In severe cases the leaves may be largely killed.

Late Blight. — This is perhaps the most destructive disease of the potato in the northern part of the United States. It is caused by a fungus (*Phytophthora infestans*) which attacks leaves, stems and tubers. It is first noticeable on the leaves as dark, watery areas which later become brown and dry. In cool, wet weather the disease may spread with almost phenomenal rapidity, killing the vines, on which the dead leaves hang shriveled and dry (Fig. 2). Later the vines become prostrate. From the diseased vines the spores of the fungus fall upon the soil and are washed in by the rain, infecting the tubers. On the tubers the disease takes the form of a dry rot. On the outside the affected areas are discolored and become somewhat sunken with age; beneath these areas the flesh becomes reddish brown and decays to a depth of not over a quarter of an inch (Fig. 3). In storage this rot spreads among the tubers and may cause much loss.

Fig. 2.—Late blight. (After New York (General) Experiment Station Bulletin No. 241.)

In wet weather or on damp soil a watery rot is often associated with this disease. This is due to bacteria which gain entrance from the soil through the diseased spots.

Control. — See general spraying directions. In addition to spraying, —

1. Allow no decayed or partially decayed seed to go into storage.

2. Select clean seed tubers, known to have come from healthy vines.

3. Store in a fairly dry, cool place.

4. Avoid planting on wet, poorly drained land, or where the blight was serious the previous year.

Fig. 3. — Late blight rot of tuber. (After Cornell Experiment Station Circular No. 19.)

Scurf or Rhizoctonia. — This disease has become prevalent throughout Massachusetts. It appears on the surface of the tuber as small, black, hard bodies called sclerotia, which appear like particles of soil but are not easily rubbed off (Fig. 4). In severe cases deep pits resembling wire-worm injury may be produced. The real serious phase of the disease occurs on the young shoots, which become affected from seed tubers. On the lower part of these shoots dark decayed spots or streaks appear, often causing death even before the shoots appear above ground (Fig. 5). When this occurs new sprouts usually develop, but these in turn are likely to be killed or weakened by the disease. Affected shoots which are not seriously enough diseased to be killed develop into weak, sickly tops. The so-called "little potato disease" is a phase of this trouble.

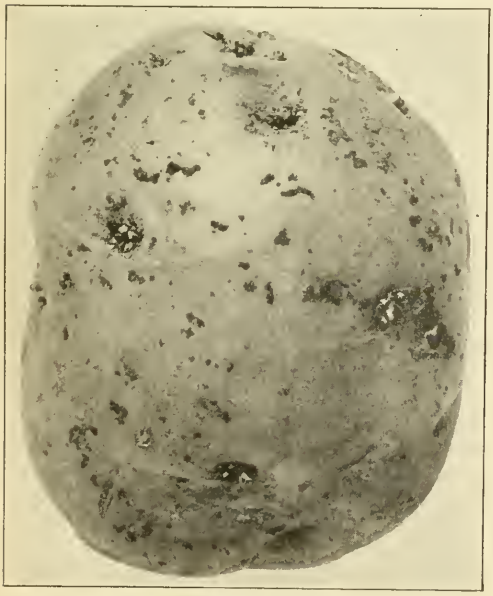

Fig. 4. — Scurf or Rhizoctonia, showing black sclerotia on tuber surface.

Control. — Do not plant potatoes on the same land two or more years in succession. Avoid using seed tubers on which the black sclerotia appear. Treat seed tubers, before cutting, with corrosive sublimate solution (2 ounces to 15 gallons of water) for one and one-half hours. Dissolve the corrosive sublimate in a small quantity of hot water and dilute to the required strength. Tubers may be placed in sacks or in slatted crates for dipping, after which they should be spread out to dry. It is also convenient to have two barrels with spigots near the bottom. One barrel is filled with potatoes and these are covered with the solution. After treatment the solution is drawn off and poured over another lot of tubers in the second barrel. The tubers in the first barrel are then spread out to dry and the barrel refilled. The solution may be used three times, it being necessary only to keep the quantity up to the original amount by adding more of the same strength. The barrels are set on boxes with a space between for convenience in drawing off the solution into pails. Treated tubers may be planted at once or stored, but care must be taken not to reinfect them by placing in infected sacks, crates or bins. The sacks or crates used for dipping may be employed for storage purposes when dry.

Fig. 5. — Showing effect of Rhizoctonia on young shoots. (After Maine Experiment Station Bulletin No. 230.)

Scab. — This disease appears as rough, scabby areas on the tuber surface (Fig. 6). It is caused by one of the higher bacteria which live in the soil. The disease does not penetrate the flesh of the potato, and its chief harm is the unsightly appearance which it gives to the tubers, thus reducing their market value. Shrinking and loss of weight in storage result from rapid evaporation of moisture through the scabby surface.

Fig. 6. — Scab.

Control. — Do not plant on land from which scabby potatoes were harvested the previous year. Avoid the use of lime, wood ashes and basic slag, as scab develops more freely in alkaline soils. Stable manure also favors development of the disease.

Treatment of " seed " tubers to destroy the scab organism should always precede planting. It is advisable to use corrosive sublimate solution recommended for scurf, as this is equally effective against scab. This should be done *before* sprouts start and *before* cutting; otherwise injury may result. Soaking in formaldehyde solution (1 pint to 30 gallons of water) for two hours will kill the scab organism, but this is not efficient against scurf, which is becoming more common and troublesome than scab in Massachusetts.

Blackleg. — This is a bacterial disease. It causes early rotting of seed tubers after planting. From these it spreads upward through the young shoots, which turn black and rot below the ground (Fig. 7). Diseased plants are stunted, turn yellow and die early without setting tubers. The disease, which is usually most troublesome in heavy, wet soils, is now of frequent occurrence in Massachusetts.

Control. — Control measures should begin with the selection of clean, sound seed tubers. Disinfection of seed tubers for scurf and scab will kill any of the blackleg bacteria which may be on the surface, but this will be of no avail if the tubers are in the least decayed, as the solution will not reach the interior.

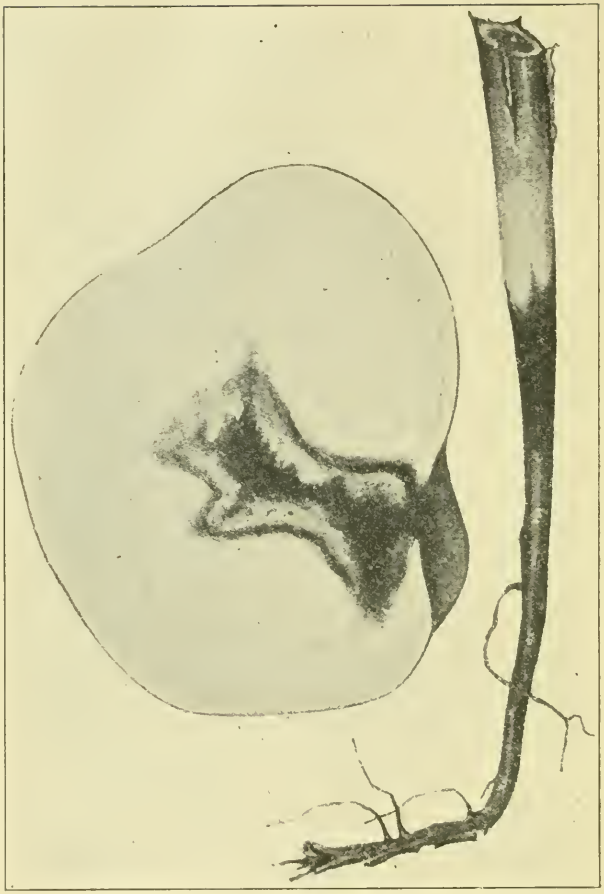

Fig. 7. — Blackleg, showing blackened base of young shoot which has become diseased from decayed seed piece. (After Wisconsin Experiment Station Circular No. 52.)

Dry Rot and Wilt. — This disease, caused by a fungus (Fusarium), attacks both tubers and stems. In the tuber it causes brown discoloration of the so-called bundle ring just beneath the surface. This is easily seen when an infected tuber is cut crosswise at the stem end (Fig. 8). In storage the fungus may cause a dry, powdery rotting of the entire interior of the tuber. The disease spreads

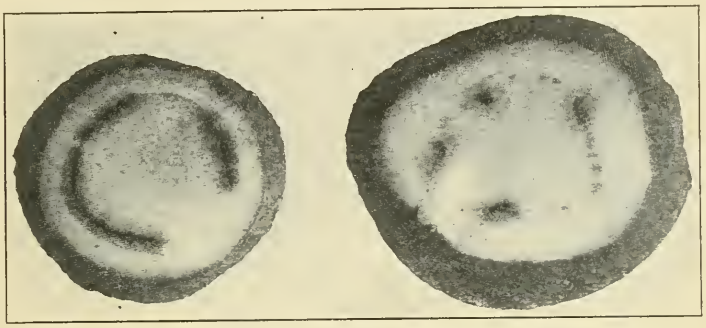

Fig. 8. — Dry rot, showing discolored bundle ring at stem end of tubers. (After Bulletin No. 55, Bureau Plant Industry, United States Department of Agriculture.)

upward from infected seed tubers into the stems, causing them to turn yellow, wilt and die prematurely. Often diseased plants may be detected before wilting by their stunted, yellow appearance.

Control. — Discard all seed tubers which show discoloration of the bundle ring at the stem end. Do not plant for five years on land where the disease has occurred.

Sprays.

Potatoes are sprayed principally for the control of early and late blights and for insect pests. The following schedule is adapted to Massachusetts conditions: —

First Spray. — When the plants are about 6 inches high, use Bordeaux mixture (4–4–50 formula), to which should be added 3 to 6 pounds of lead arsenate paste or 2 to $3\frac{1}{2}$ pounds of lead arsenate powder for each 50 gallons.

Second Spray. — Ten days to two weeks after the first application, using the same mixture.

Subsequent Sprays. — The crop should be sprayed with sufficient frequency to keep the vines well covered with spray material. In wet seasons this may mean as often as every ten days, but ordina-

rily once in two weeks, as long as the vines remain green, will suffice to keep diseases and insects under control, providing the work is done thoroughly. For all spraying after the first two applications use the 5–5–50 Bordeaux mixture, with the same amounts of lead arsenate.

Directions for making Bordeaux Mixture.

Bordeaux mixture is composed of copper sulphate (blue vitriol), lime and water, and these substances are combined in various proportions for different purposes. The following directions are for making a standard solution known as "4–4–50 Bordeaux mixture." The first figure in this and similar formulas indicates pounds of copper sulphate; the second, pounds of lime; the third, gallons of water.

1. Dissolve 4 pounds of copper sulphate crystals in about 2 gallons of hot water, using a wooden container, or dissolve by suspending the crystals in a coarse sack in a half barrel of water.

2. Slake 4 pounds of fresh lime in a wooden tub or half barrel, adding water slowly and in no greater quantity than is necessary to insure thorough slaking. Upon completion of the slaking enough water may be added and stirred in to make the mixture the consistency of thick cream.

3. When cold the lime mixture is poured through a wire strainer (about 20 meshes to the inch) into the spray barrel and water added to half fill the barrel. Straining is necessary to remove particles which would clog the spray nozzle. The copper solution, diluted to 15 or 20 gallons, is poured slowly into the lime mixture and water added to fill the barrel. The mixture, promptly and thoroughly stirred, is then ready for use.

When large quantities of Bordeaux mixture are required it is more convenient and economical of time to make up stock solutions of copper sulphate and lime as follows: —

1. Dissolve copper sulphate crystals in a barrel at the rate of 1 pound of crystals to each gallon of water.

2. Slake a quantity of fresh lime and dilute it to make up a solution containing 1 pound of lime to each gallon of water.

3. Thoroughly stir both stock solutions before removing portions for dilution, in order to insure even distribution of the ingredients.

To mix for spraying, 4 gallons of the lime solution is strained into the spray barrel and made up to 25 gallons; 4 gallons of the copper solution further diluted is poured in and the barrel filled with water. Prompt and thorough stirring completes the mixture for use.

To make the 5–5–50 mixture, simply increase the amounts of copper sulphate and lime by 1 pound each.

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COMMON STORAGE OF FRUITS AND VEGETABLES.

EDWARD HOWE FORBUSH.

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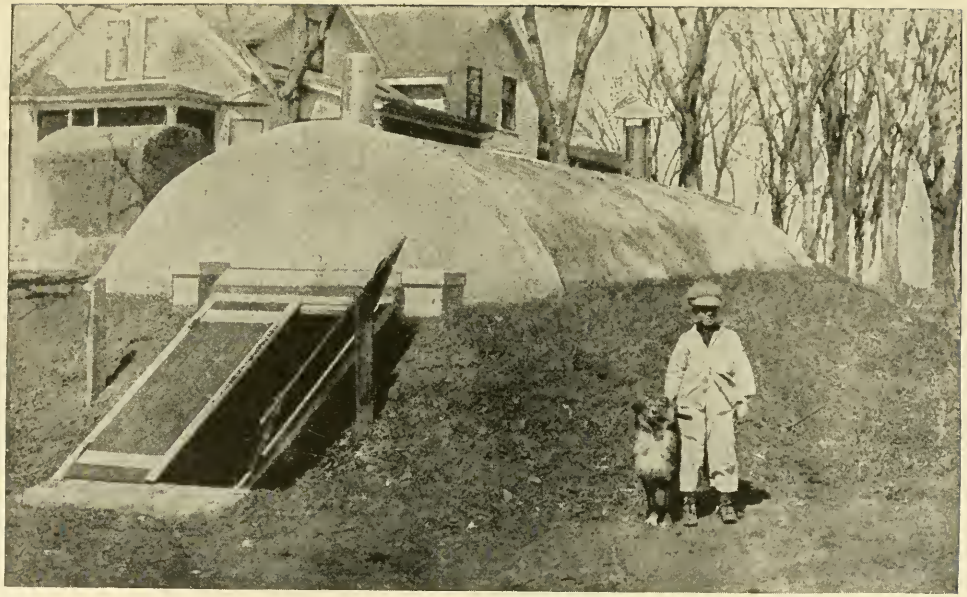


A potato storage cellar partly covered. The cellar should be completely covered with earth to protect it against heat in summer and cold in winter. (Illustration by courtesy of Portland Cement Association, Chicago.)

Common Storage of Fruits and Vegetables.

EDWARD HOWE FORBUSH.

Introduction.

The object of this circular is to furnish indispensable information to many amateurs now engaged in producing a surplus of vegetables and fruits for fall and winter use.

At this moment (June 25, 1917) innumerable small gardens exist in Massachusetts. In many towns almost every house has its garden; some are mere patches of a few square feet, others combine the ordinary garden with much of the back yard and even the lawn. Many lawns have been plowed and planted to potatoes. Vegetable seeds of all kinds have been sown, and in most cases the plants are up and already flourishing. Extra care is being taken to produce an unusual fruit crop. If these efforts are successful a great surplus of perishable products will be forthcoming, the markets will be overcrowded, and unless suitable storage facilities are provided, forthwith, a large part of the food products raised will be wasted. On the other hand, if these vegetables and fruits can be properly stored and cared for, a much-needed addition to the food supply will be saved.

Farmers may find the early markets overcrowded with perishable products, and many will need to better or enlarge their storage facilities in order to preserve their supplies until the time of need that is sure to come in view of the great demand for all food products that will attend the continuance of the war. Hence the publication of this circular will be timely. It is designed to treat of common storage facilities that all can utilize, and has no reference to cold storage where ice is used. It does not touch upon canning, which has been treated of in Circular No. 55, nor upon drying fruits and vegetables, which is taken up in Farmers' Bulletin 841, issued by the United States Department of Agriculture at Washington.

House and Cellar Storage.

Storage to be successful requires suitable moisture and temperature, proper ventilation of the storage chamber and sufficient maturity of the fruits and vegetables stored therein. The conditions vary somewhat with different products, but most of them may be stored successfully in a well-drained cellar or cave properly ventilated, where a temperature between 32° and 40° F. may be maintained during the winter.

Most dwelling houses to-day have cellars, and the cellar always has been the chief storeroom for fruits and vegetables. In some parts of the State many farmers have no cellar worthy of the name, and there are some old houses in southeastern Massachusetts that are provided with only a mere pit lined with brick, or a hole in the ground. Many, however, are heated by means of a furnace or other heater situated in the cellar, and such are unfit for the storage of vegetables and fruits, as heat and lack of moisture tend to dry out or rot such products. For this reason many people have given up storing fruit and vegetables in recent years, and have bought these articles in small quantities from week to week at excessive cost. As a matter of economy this practice should be given up. As the cellar is the most convenient place, it is important to provide adequate facilities for storage therein or connected therewith.

Storage in or near Heated Cellars.

The chief objection to the storage of vegetables in the house cellar is that disagreeable if not unhealthful odors arise from decaying material. This trouble may be avoided by proper ventilation. *Every cellar wall should be proof against rats.* Walls made of properly tempered concrete are rat-proof, and if such walls extend 3 feet underground rats will not burrow beneath them. On side hills, however, where one end of the cellar wall is exposed, it is necessary to have a concrete floor underlaid with 6 inches of gravel to prevent rats burrowing into the cellar. Rat-proofing of cellars and buildings is fully described on page 33 of Economic Biology Bulletin No. 1, "Rats and Rat Riddance," published by the Massachusetts State Board of Agriculture.

Partitioning the Cellar.

In most houses the heater is situated under the main part of the house, and where there is an ell with the cellar extending under it, this may be partitioned off and used for storage. A double brick partition with an air space between the two walls and the interstices between the brick thoroughly plastered, makes a fairly good barrier, if supplied with a door on each side. A double door is necessary for insulation. Where it is necessary to enter the storage cellar and go through it to reach the heater, the doors should be arranged with springs or weights to close them. A double board wall may be used nailed to upright 2 by 4 timbers. These walls may be lined with heavy building paper. Where eelgrass, commonly known as seaweed, is available, the spaces between the boards may be filled with this, as it is one of the best insulating substances. Sawdust, ground cork or mill shavings may be used. All of these materials must be dry when put in and must be kept dry. The storage cellar should be ceiled overhead with matched boards and heavy building paper, or by using plastered ceiling. A still better but more expensive plan is a double ceiling with the paper between the boards. Ventilation may be secured by using a cellar window or windows, by means of which cold air may be let in. Windows should be double, or, better still, have a wooden shutter on the outside of each window frame.

Storage Closet in Cellar.

An inexpensive closet may be made in a heated cellar, which will contain all the fruits and vegetables needed for an ordinary family. A corner of the north side of the cellar should be selected containing a window if possible. Otherwise a window should be put in for ventilation. The cellar furnishes two sides of the closet, and the others may be made from boards, concrete or brick. Hollow tile makes excellent partitions, but in any case space of at least 6 inches should be provided between the walls, and they should be made tight, and lined with heavy paper. If boards are utilized it may be necessary to use concrete or cement to make a tight joint where the walls join those of the cellar. The closet should have double doors. Such a

closet 8 feet square will meet the needs of an ordinary family. In general, the dirt floor is best for storage purposes, particularly if the cellar is well drained (as all cellars should be), as the earth provides sufficient moisture; but in the case of a concrete floor it will be well to keep a pail of water in the closet. Fruits and roots may be put in such a closet when the weather becomes too cool for storage outdoors. A thermometer should be hung halfway up the wall of the closet, and the temperature should be kept nearly uniform and not very far above the freezing point. This can be regulated by means of a double window, through which cold air may be let in, and by the double door, through which warm air may be admitted in case of very severe weather and danger from frost.

House Rooms or Closets.

Rooms or closets in heated houses are not proper storing places for most fruits and vegetables. Usually there is not sufficient moisture or ventilation, and the temperature cannot be kept uniform, but in houses where regulated heaters keep up a certain degree of heat day and night, fruits or vegetables may be kept in rooms or closets not directly heated and not exposed to freezing temperature, particularly if they are wrapped in tissue paper or newspaper, which helps to retain moisture, and enclosed in boxes or barrels. Such storage, however, should not be attempted wherever cellar or pit storage can be resorted to, except perhaps for squashes.

Storage in Barn Cellar.

Root crops for the feeding of cattle are stored commonly in barn cellars that are free from frost. In some cases it may be necessary to cover the roots with straw, meadow hay, corn fodder or seaweed, as an additional protection. Barn cellars that are reasonably clean may be used for storing a surplus of roots and vegetables for market or for home use, but for this the outdoor root cellar or cave is preferable.

Root Cellar connected with House Cellars.

Lacking cold storage, one of the best possible means of storage is the root cellar. This is most convenient if connected with the house cellar, and may be built under the house, or outside the house and connected with the cellar. Such a cellar should have concrete walls and a slightly pitched roof, and may be covered with planks or concrete, then with a layer of sod, then with 2 to 3 feet of earth and another layer of sod carefully placed. If the land slopes away from the house the water from the roof will run off, and if the main cellar is dry the root cellar should be dry. All root cellars should have ventilators to allow excess of dampness and odors to escape, and to regulate the temperature. The ventilator may be opened to let in cold air except in very severe weather.

Outdoor Root Cellars.

Ordinarily few people, except farmers or those owning large farms, will go to the trouble and expense of building a cellar or house especially for the storage of fruits, vegetables or roots. The experienced farmer needs no advice on such matters; but inexperienced people purchase farms, and such need instruction in regard to the storage of surplus products. Perhaps the best outdoor cellar is the sod-cellar, or cave, constructed on a side hill. If possible, this should be arranged so that the entrance will face the south or east, that it may not be exposed to cold north or northwest winds. This form of storage is inexpensive, the cellar is easily constructed and frost-proof, and the earth thrown out may be used for covering. Perhaps the best form of cellar is that built of concrete. This will be rat-proof and also waterproof if a well-drained site be selected. If the cellar is not dry a tile drain should be constructed beneath the floor to carry off water. If the roof is arched and is not over 8 feet wide, an 8-inch thickness of concrete and a layer of earth not more than 2 feet thick should suffice to cover the cellar. The front wall which is exposed directly to the frost should be double, with an air space and double doors. It is well also to have a screen door covered with wire-mesh netting for use in

ventilation and in cooling. Wood may be used instead of concrete, but it is not rat-proof. The two front walls should be 1 or 2 feet apart, and the space between should be filled in with earth. The walls may be supported by planks and the roof by timbers and planks overlaid with a layer of sod, and 2 feet or more of earth and a top covering of sod. Such a cellar may be ventilated by means of a drain tile projecting from the roof. The tile ventilator should have a raised projecting cover or roof to shed rain, and it might be necessary to cover it tightly in very severe weather. Such a cellar 8 feet wide and 30 feet long would hold 700 bushels of roots. The roof may be arched or may have rafters and a ridgepole. On level ground root cellars are constructed partly above and partly below the surface, but they must be well drained and provided with thick double or triple walls with one or two wide air spaces between, and such buildings are expensive.

Ditch Storage.

Where it is necessary to store only a small quantity of roots a ditch in a well-drained hillside will answer every purpose. A ditch may be dug 1 or 2 feet in width and 3 feet deep and half filled with vegetables, such as beets and turnips, and covered with straw or seaweed before danger of freezing. In severe weather it may be necessary to cover with earth, over which, in turn, boards may be laid and even another layer of straw and one of earth. The lower end of the ditch should not be obstructed except by straw or similar material, on account of drainage. The writer has kept roots and vegetables in such ditches throughout the winter.

Outdoor Pits.

Farmers and market gardeners keep quantities of vegetables successfully in outdoor pits, and even fruit has been kept satisfactorily in such a manner, but fruit is likely to lose its flavor when too near the earth. Vegetable pits are constructed on a side hill if possible, or dug down 6 or 8 feet deep, so that the contents are kept considerably below the surface of the ground. Such a pit usually has a double pitch roof with an opening covered by a 3 by 6 feet shutter, or something similar. This

allows ventilation. When the severe weather of winter is at hand the roof and the sides, if there are any above ground, are banked up and covered with meadow hay, straw or horse manure to prevent freezing. If vegetables are to be kept well into the spring the pit should be opened on cool spring nights and closed and covered during the daytime, so that the temperature may remain low. One difficulty with a pit on level ground lies in the matter of drainage. Where the drainage is not good it may be better to stack the vegetables on the surface of the ground and cover them.

Surface Storage.

The writer has had excellent success in storing potatoes and other vegetables in the open. If the ground is fairly dry potatoes may be piled in a conical heap directly on the ground itself, or on pine needles, or straw if there is danger of too much moisture. The conditions requisite to success are, first, dense shade, such as that of evergreen trees or buildings; second, protection from severe north winds during cold weather; third, proper covering; fourth, protection from rats, mice and squirrels. There is little danger from these rodents, however, after the ground freezes. The pile should be made in cold weather and should be covered at least a foot deep with straw, meadow hay or seaweed. This may be held in place with a few boards and allowed to stand as long as the vegetables are safe from frost. It should then be covered with a layer of earth, and a wisp of the roughage may be allowed to project through the top for ventilation. This process should be continued until three layers of straw and earth have been placed on the pile. This seems to be sufficient protection to keep garden vegetables in Massachusetts.

Special Care of Certain Products.

Some fruits or vegetables will keep better under special treatment; others will keep very well until the latter part of the winter, when they require particular care. Some need more moisture than others, and some, like squashes, require a higher temperature. For these reasons special instructions are needed for such products.

Handle with Care.

All fruits should be handled like eggs, and in preparing fruit for storage all that is bruised or damaged should be discarded. Windfalls should be sold for what they will bring. Pouring fruit into barrels is likely to bruise or injure some of it, and all such injuries impair the keeping qualities. Some vegetables are equally fragile. The shells of squashes and the stem ends are readily injured, and such specimens are likely to rot; therefore care should be used in handling.

Squashes and Pumpkins.

Squashes and pumpkins should be stored in a comparatively warm, dry atmosphere. They will keep well at a temperature of 40° to 50° F. When placed in open crates in some upper room near the chimney they ought to keep well if a continuous fire keeps the chimney warm. Squashes, pumpkins and sweet potatoes will do well often near a furnace room in the cellar, but not in cool, moist cellars.

Parsnips, Salsify and Horse Radish.

These may be left over winter in the ground where they grew, as freezing does not injure them and actually improves the tenderness and flavor of parsnips. It may be more convenient, however, to dig them and place them in piles on the ground, covering them with 6 inches of soil.

Cabbage.

For early winter use cabbages may be stored in the cellar by packing in barrels of sand. For later use they may be placed in outdoor pits or trenches. Cabbages can be kept perfectly in dry soil. Some place them heads downward; others reverse the order. They are kept commonly by standing them on their heads on the surface of the ground and banking them up with earth. They are placed in long rows three heads in width. Three heads are placed side by side and two more on these, and earth is filled in so that the roots barely appear at the surface. They are thus stored with the leaves intact.

Celery.

Celery plants usually are banked up or covered with earth before frost endangers them. Then as the weather becomes colder the resultant ridge may be covered with straw, horse manure or corn fodder, and they may be kept thus banked until cold weather. They should be taken out, however, before the ground is frozen hard. Many large growers handle the last of the crop by "trenching." First, the rows are banked with earth and allowed to remain there so long as there is little danger from heavy frosts. Then the plants are lifted and eight or ten rows are brought together and set, with the roots bedded close together, in the bottom of a shallow trench. Sometimes blanching boards are set along the sides of the trench and the celery filled in between. The sides are then banked up with earth and a covering of boards, straw or some similar material is put on. In this latitude such a trench must be well covered and well ventilated. Some of the large growers store celery in a large, roofed pit, giving it extra ventilation, covering and special care. Sometimes, for home use, celery is dug roots and all and planted in moist earth on the cellar floor, or placed in the cellar in boxes or barrels with the roots down and earth around them. The plants must be kept dark and cool with good ventilation, and the soil about the roots must be kept moist, but wetting the tops should be avoided. When handled in this way the plants grow slowly and the exclusion of the light blanches them.

Onions.

Onions, when well cured, keep best, tied up in bunches by the tops and stacked like hay, if stored in *dry, well-ventilated* pits. Some growers prefer to store them in contact with the earth. Onion storage houses must be *kept dry* and frost-proof.

Apples.

Apples for storage should be well matured, but firm and hard. They should not be allowed to lie on the ground in the sun to ripen, as such fruit decays early. When picked they should be cooled overnight in the field in open boxes, and kept in a cool place thereafter. Apples keep best at a temperature a

little above freezing point, and require considerable moisture to prevent shriveling. Some long-keeping varieties, such as russets, keep well on the cellar floor. Many experiments have been tried, such as wrapping apples in paper and packing them in sand, sawdust or ground cork. In general, these experiments have worked well, if the packing medium has been a little moist. Too much moisture, however, causes the apples to crack, if not to rot. One successful grower kept a stream of water running through the storage room. Another was in the habit of wetting the floor of his storage house, and even wetting the barrels in which russets were stored, with a hose. Paper wrappings are considered an advantage in packing several kinds of fruit. They help to retain moisture and an even temperature, and also prevent the spread of disease from one apple to the other. No doubt directions regarding apples will be useful in storing pears. Common storage of apples is treated quite fully in Farmers' Bulletin 852, issued by the United States Department of Agriculture at Washington.

Special Provision for Fruits and Vegetables in Cellar Storage.

All natural light should be excluded from potato storage houses, because when the tubers are exposed to even modified light they are soon injured for food purposes.

Immature potatoes cannot be successfully stored for any considerable period even in the best of storage, and should never be pitted or buried.

Where potatoes or other roots are stored in quantity they may be piled directly on the cellar floor or upon a layer of straw. In a cellar storage closet apples, potatoes and onions should be placed near the floor or upon it. They may be kept in boxes or barrels, above which shelves may be fixed on which other vegetables and fruits may be stored. If squashes must be kept in the cellar they should be placed near the ceiling, where they will get the highest temperature and all the ventilation possible.

Storage of Canned Goods.

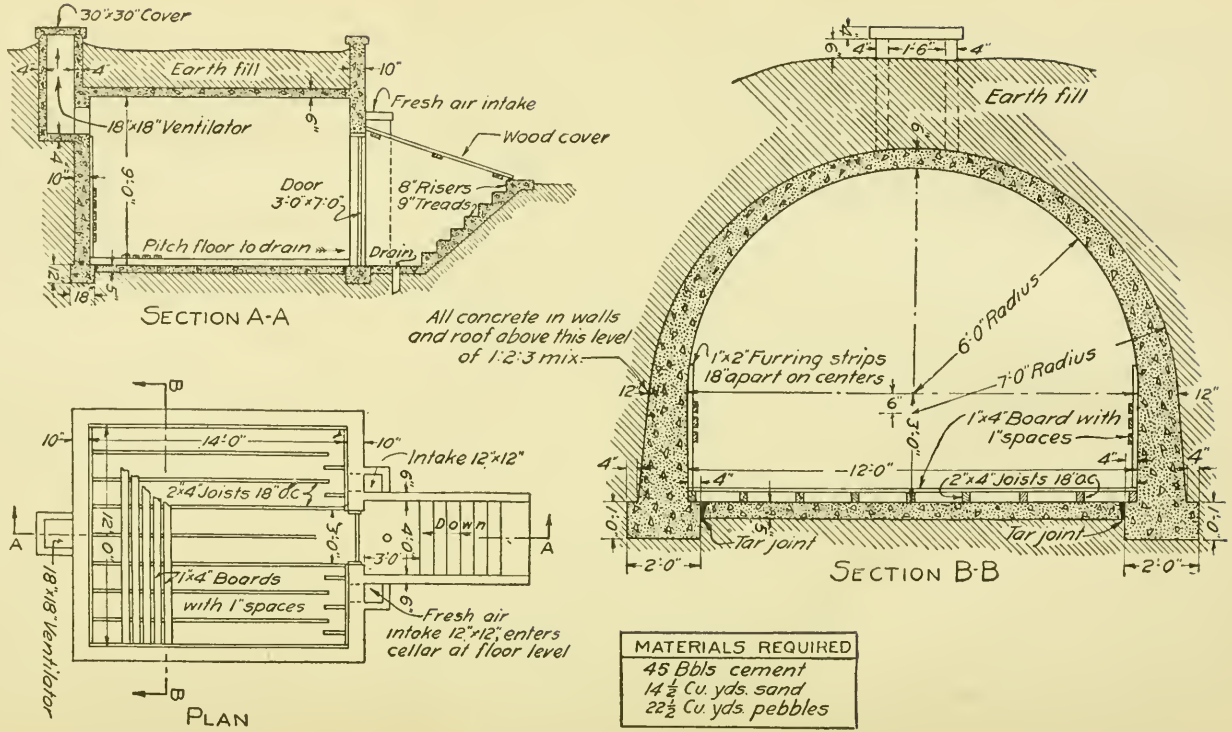
The novice may not know that canned goods must not be exposed to direct light. Canned fruit and vegetables in glass jars should be wrapped in paper and kept in a dark, airy place. If

kept in the light they deteriorate rapidly and are likely to spoil They may be stored on shelves in the upper part of the cellar closet, hereinbefore described. One advantage of the wooden outside shutter for the window is that it keeps the place dark, and so allows the storage of canned goods.

Corn Storage.

Seed corn may be kept perfectly by hanging it under a roof or porch or under wide eaves, where it will get the air and be protected from storms, birds and squirrels. Small quantities are cured by stripping back the husks and hanging up the ears in bunches.

The old-fashioned New England corn bin or corn crib is a good model for keeping corn on the ear. It has a pitched roof, wide, projecting eaves, and overhanging, slatted sides which keep off rain and permit air to circulate through the building. Usually it is mounted upon posts 2 to 3 feet high, with inverted milk pans on top of the posts under the building to keep out rats. This provision alone is not always successful, however, and a sure additional method of protection against rats, mice, English sparrows, jays, squirrels and other marauders is to line the inside of the crib with galvanized cellar-wire netting. If this is thoroughly done the corn is safe from anything larger than an insect, and ordinarily there is little trouble with insects in corn cribs in Massachusetts.



Concrete storage cellar for the average farm. Capacity about 600 bushels of potatoes. (Illustration by courtesy of Portland Cement Association, Chicago.)

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The Value of a Market News Service to Farmers and Fruit Growers.

HOWARD W. SELBY.

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THE VALUE OF A MARKET NEWS SERVICE TO FARMERS AND FRUIT GROWERS.

HOWARD W. SELBY, DIRECTOR, MARKET BUREAU, EASTERN STATES EXPOSITION, SPRINGFIELD, MASSACHUSETTS.

I was asked, before coming up here, if I would have something interesting and amusing to say in the course of this hour this morning, but the subject that has been chosen is "The Value of a Market News Service to Farmers and Fruit Growers." This is not a most interesting sort of a subject, but it is one of the most practical that might be presented and discussed at this morning's session.

It has been an interesting study to note the development in the market-gardening and fruit-growing business, especially in the way that the farmer and producer has been keeping in touch with his product from the time it leaves the farm until it is sold on the market. It is becoming somewhat obsolete to find the farmer who is removed a few miles from the market who fails to know and realize what price his products have sold for until a week or ten days or more — two weeks — have elapsed.

I have been surprised, however, in the course of the last two weeks to learn that some of the men on the outskirts of Boston, who are selling their products through the regular channels of the commission houses there, are failing to receive returns until the end of the second week; and furthermore, fail to know and realize what their goods have brought on the market. I think there is nothing weaker in the line of market gardening or any especial line of farming than that great weakness which has been brought out in that particular instance.

I used to go down, a number of years ago, on the eastern

shore of Maryland and Virginia, and there they were producing cantaloupes in great quantities, shipping them from the farms to the cities of Philadelphia, New York, Boston and other points. The returns from those cantaloupes would be received, as I have stated, from ten days to two weeks, sometimes a month, after the shipment was forwarded. The returns would be anywhere from postage stamps to a fairly reasonable sized check. But during all of that time the farmer continued sending his shipments on without a knowledge of what the outcome or the return would be.

Now, I would hesitate to speak along that line or even make the slightest mention of it this morning, except for the fact that it has been called directly to my attention that this case continues to exist around the largest city in this State; and that farmers within 20 to 30 miles of Boston are still operating their business on such a method as that. It is an absolute lack of system, — an absence of the fundamental principle which is absolutely and entirely necessary to success.

That same principle applies to the Jersey farmers, with whom many of you are familiar, who bring their produce to the Philadelphia market from day to day. There was a time, a few years back, when they did not know what that produce was bringing, but to-day they are receiving either a telephone call or a postal communication the following morning, telling at what price the product sold.

That is enabling them, whenever it is possible, to force their products through, and, if they are within reasonable hauling distance of the city market, to bring in shipments or their loads later in the day and so manage to sell them on the high market while it continues. The telephone, therefore, and the postal service have been the first two factors in developing real market news service, — in making it possible for us to know whether the products grown on the farm are bringing the actual cost of harvesting and of shipping.

Now the development as it comes in that line — the one from the merchant to the grower — is the one we have stated, but there has been another significant growth in the line of market news service. This has been effected more especially where there has been organized effort manifested on the part of the

growers. More notable is the Eastern Shore of Virginia Produce Exchange, which has placed a representative on a number of the large city markets in different sections of the country. They have their sales agent on the Philadelphia, New York, Chicago, Boston, and, I think, about six or eight other leading markets, — the largest markets throughout the country.

These men, in their original plan, drew in the information from surrounding cities. The representative in Chicago would know what the prices were in Milwaukee, Minnesota, St. Paul, Des Moines and, in the beginning, in St. Louis. He would be in touch with that entire radius of territory, and then assemble the information and send it on to their central office in Onley, Va.

That work has been supplemented now and is being done on a more efficient and wider basis through the channels of our own Department of Agriculture, — the Bureau of Markets. Many of you have been brought in touch more directly in this past season with the results and benefits of that particular service. That service is divided into two main, two principal, forms. There is one which was started originally three or four years ago and extended its operations into Philadelphia, New York, Boston, Pittsburg, Buffalo, Chicago, Cincinnati and St. Louis. I think that covers the entire number on their western circuit.

This service was started for the purpose of reporting car-lot shipments, and was covering only a few selected commodities. The five or six particular commodities covered are potatoes, onions, cabbage, sweet potatoes, watermelons, cantaloupes, peaches and apples. Some of those you will notice have their short seasons, and are still handled only during those seasons, of course. The other commodities, which are the staple, the non-perishable or semi-perishable products, are handled or reported on the year round.

The report of the service was met with by opposition in the beginning on the part of the men in the different cities who were selling the commodities. They immediately saw the result and effect it would have on their business, especially some of the men who were selling at a fair price and returning at a different price. This had a very direct benefit for the producer, inasmuch as it was a check-up on market conditions, and re-

ported them directly as official government information to the producers. It has brought about a marked benefit in that regard, but it has handled car lots only. That service is being extended through a recent appropriation, so that it will cover an increased number of cities, in which will be included Cleveland, Detroit and a number of cities which come in the second class and which heretofore have not been covered.

Now, there is one sort of market news service that has been extended into this section on a larger scale this past summer. It deals with local products, — the products of the market gardeners who are within short distances of the city markets; and it deals chiefly with less than car-lot volumes of business, or less than car-lot shipments. There has been an extension of that work in this part of the country into the cities of Providence, Boston, Springfield, Bridgeport and Albany. Some of the growers who are present this morning acknowledge and have expressed their interest in and appreciation of this service. They have recognized the value which has come from it.

They have recognized, further, that the government is extending such service and giving the most valuable help only to the sections where there is a tangible organization with which they can work. There was the Market Gardeners Association in Providence, the same type of organization in Boston, another in Springfield and in Bridgeport, with which the government found immediate and ready co-operation. This enabled them to make their work and service more effective, because they were certain that they could secure the results where there were a number of men banded and grouped together who were sufficiently interested themselves to study the problems that were before them.

I have taken this as a single illustration of the value of co-operation of local organizations as it is viewed by the government in Washington, because the notable illustration and instance is in the fact that that service has not yet been extended to any city where there is no local market gardeners' or producers' association. That is rather suggestive to some of you men who may come from the cities where you have not yet banded yourselves together in a working organization.

There are a number of benefits which the producers report

they have derived from this, and they have been of an immediate and a cash value to them. I have cited an instance several times, — the spinach illustration from the city of Providence.

Last June spinach was selling on that market at 45 cents a bushel. At that rate the producers were hauling it in in increasing supplies, and when it came to Wednesday morning the producers stated to Mr. Taylor, the agent of the Bureau of Markets, that they expected there would be a tremendous glut on the market, especially by the latter part of the week. But they continued to hold their nerve, and on coming to market Thursday morning started their price — as is the custom on most farmers' markets — where they left off on the day before. They started at the 45-cent figure, and it continued through Thursday at that price.

They said, "This is surely providential and something unusual, but it will be to-morrow that the market will break." And so in their habitual manner, on Friday morning, although the supply of spinach had greatly increased, they started the price at 45 cents a bushel. It sold for a while at 45 cents, and later was reduced to 40 cents; but the market was cleared up on spinach at that figure.

They said, "To-morrow is the day, because the people of Providence are surely full of spinach before this time, and we will not be able to sell the supply that we will have come to market in the morning." But starting in their accustomed habit at 40 cents a bushel, they were surprised to find the spinach had sold entirely at an early hour without a decline in the price.

Now, the reason for that they were kind enough to attribute directly to Mr. Taylor's work through the Bureau of Markets. It was because of the fact that publicity had been made use of relative to the abundant supply of spinach. The article had been reported in this manner, that "spinach was now at the height of the season, and it could be bought to best advantage for canning for the coming winter's supply."

The women read those articles; they had the close co-operation of the newspapers, and they were publishing all of this information. In connection with that article there were state-

ments made of government recipes of different ways to use spinach, showing housewives that there was more than one way in which this vegetable could be used, and used with delight and profit. As the result and outcome of that publicity and that agitation — that more spinach be consumed — more spinach was consumed; and as I have contended before, in the meetings of our Vegetable Growers' Association of America, we are in the position, — if we are properly organized to dispense this news information, — to feed the people of the United States the products as they come to the height of the season, and we can, through the proper use and channels of publicity, educate the people to eat the products when they are at the height of their season. If there is any one thing in regard to the business of market gardening that we are woefully failing in, it is in that one particular above all others.

There are other problems that enter in, but the manufacturer is making his success through publicity about his products. The people of California through their organizations are making a success through the fact that they are advocating that the housewife consume that which they have produced, and which they are placing on the markets for her use. This possibility does not reside solely in the California people, and although they have a remarkable boosting spirit, and one which we admire and sometimes envy, at the same time there is a similar possibility right here through our market News Service which the government is trying to urge upon us, and which it is offering to various cities throughout the country.

The day after I was in Providence, when I found spinach there selling at the price of 40 cents a bushel, or at the rate of about $1.25 a barrel, I found it was selling on the markets in Albany at from 10, 20 to 75 cents a barrel, with an extreme glut on the market. The people of Albany had no more spinach than they would have consumed had they been educated to the point of consuming it, — had they known that the spinach was there to be had at reasonable prices. But we simply come with our wares and place them under the bushel and imagine a consumer and storekeeper is going to root under there and dig them out from their burial place. Now, that is the way we are conducting business, and here is the possibility of the Market News Service changing and remedying that condition.

Now you say, "There is an interference in between." The retailer might buy this product at the low price when we have the glut on the market. But the News Service was taking it to the consumer at low prices. It was doing it in this manner: an advertisement was placed in the papers, — publicity was given through the columns of the paper, — stating that the spinach was sold by the farmer at 40 cents a bushel. When she went to the storekeeper, the housewife refused to pay 40 cents a peck for that spinach, and said, "This is an unjust profit." She required that he sell the spinach at some reasonable margin of profit. When he was obliged to do this he found that he sold increased volumes, and although he objected at first to the interference in his business, — the giving of publicity to the price which he paid for the product, — admission was made later by some of the representatives of that business that they had sold an increased volume, which had more than made up for the difference which they had formerly made in profit.

Now, what we wish to advocate is that these men "in between" will sell an increased volume on a closer margin, helping us to remove the glutted condition from the farm, and enabling the farmer to raise the product at a price which will warrant yielding to the claims which are made on that increased production, and which will enable the consumer to secure the product at somewhere near a reasonable price.

Do you see the beautiful condition brought about in this way? Well, it increased the price to the producer and decreased the price to the consumer. At the same time, the increased volume in between made a greater net profit for the middle man. Now, is there any policy or statement which says "cut out" or "eliminate" the middle man? It is admitting his necessity, but trying to bring a condition to bear, or a relationship to bear, which will be more in accordance with the economic laws.

I found on going into Hartford, Connecticut, upon my entrance into the work here in New England, that peaches were selling on September 6 at 90 cents to a dollar a half-bushel basket. That same product was selling on the market of Portland, Maine, on that particular, and on the following, day at $1.75 a half-bushel basket, and a scarcity on the market was reported. There was no need for the particular scarcity; there

was a lack of distribution. The people of Hartford had failed to recognize the fact that there was a scarcity in Portland, Maine. There is some admission to be made this year for transportation problems; but that condition has been found in other years, as well as in the present year, so that it is a typical illustration as well as one which applies to this particular season.

The Market News Service has proved of inestimable value to the people of the eastern shore, to whom I referred awhile ago. Its members, through their organization, are marketing all over the United States. When I went down into that country a number of years ago I found that those men recognized the three markets of Baltimore, Philadelphia and New York. That was the limit of their horizon and the extent of their geography so far as markets were concerned. When I was there two or three months ago I found those men shipping on that particular day 104 carloads of sweet potatoes. They went to 59 different markets throughout the United States.

They avoid glutting Baltimore, Philadelphia and New York; they avoid shipping to those cities and having the crop diverted, at extra cost and expense. They sent the potatoes right on to Salt Lake City, Denver, Minneapolis, Chicago and right down to Fort Worth; and 12 or 14 cars of them up here into different points in New England, — not all to Boston, but different points in New England.

Some of that information had been secured through their own channels, but a larger part of it had been secured, I was told, through the information furnished by the Bureau of Markets from Washington.

It has helped the growers, as I have stated before, who have made their consignments to the local man. So that it not only applies to the large organized institutions, such as the Eastern Shore of Virginia Produce Exchange, but also to you as individuals. It applies to you whether you haul to the Boston or Springfield market or the Providence market, or whether you go off in some of the surrounding smaller cities and sell your produce there; because how many times do the men who are selling in those smaller markets make a guess on what their product should bring? We do not recognize the law of supply

and demand in its particular relation with the guesswork or with the information of the Boston market which is received indirectly through the local retailer of the smaller city; in that way we establish our prices, and that is entirely a false method or false system.

The information which the government furnishes comes to you under franked envelope daily, telling what the prices were in Boston. You can secure reports telling what the prices were in Chicago or in any other part of the United States, but you can get the prices, if you are in the surrounding territory to Boston, telling what every item and every commodity brought on the market that particular morning.

It is having a tendency in that regard to stabilize conditions throughout the United States. It is having a tendency to stabilize that condition, as I illustrated, between the Providence market on spinach and the market of Albany, New York, because there will be an equalization of those prices brought about by the dissemination of this information. The housewives, as I have stated, have increased their demands because they have read of those commodities which are in the height of their season. As the reporting service was started there in Providence and spread in the other sections, it has literally advertised every item that has been brought in from the farms to the markets; and instead of the housewife going to the market or her local retailer, and thinking in terms of two or three commodities which she knows ought to be at the height of their season, she has the newspaper information which tells her that that retailer should have 30 different kinds of vegetables, and enumerates what they are, as well as enumerates what price he has paid for them and at how reasonable a figure she should be able to secure them. The whole system of the market reporting service is simply one of enabling that law of supply and demand to operate more freely and to operate over a wider territory, equalizing our business from the standpoint of distribution and from the standpoint, in large measure, of the prices.

Now you say, "We have difficulties sometimes in regard to those prices because we find this morning that the market in Springfield on potatoes is ranging from $1.85 to $2, while in some other sections we find it is $1.75."

Now the very knowledge that there is this difference in price will tend to equalize it when communicated to potato growers; for shipments to the low-priced markets will tend to slacken, and shipments to the high-priced markets will increase, until the prices are again in equilibrium.

Now there are several indirect benefits which I have not exactly alluded to that can come from this market reporting service. In regard to tending to equalize supplies, you know that before this sort of service was established, and before we had the telegraph and telephone communication, we would simply harvest the goods and bring them into the market without an understanding of what the different farmers throughout that section were bringing into the market.

There is an attempt on the part of this service to secure information from those growers on the market each day, so that they will state whether they expect to have their normal supply or an increased supply on the coming day. The government agent who is there can better secure that information and can give those farmers, before they leave the market, an idea as to whether a greater amount of potatoes is expected than the demand will warrant. He can guide and gauge in a large manner, and has done so in the experience of this past summer.

Another indirect benefit, as I see it, which is bound to come from this market reporting service, is in this respect. You say, "We cannot apply the thing as the Eastern Shore of Virginia Produce Exchange is doing it; we have not the goods in a common standard or common grade. There is an absence of that, and it makes our different farms have different standards; for every different farmer there is a different grade and different standard." Some will say that we are beginning at the wrong end by advocating a Market News Service before we have first advocated and put into operation a common grade and standard law.

Well, the result of this is that we have seen the confusion and we have seen the weakness in the service and the system, which means that national legislation is being attempted along the lines, first, of grading and standardizing apples, so that there will be a report come in from Buffalo, New York, and one from

Cincinnati, and another from Boston and Portland, and we will have some understanding as to what it means. It will not represent a different standard in Buffalo and a different standard in Boston, but it will bring us together to know and to get a legislative standard that will help solve that problem. It is going to teach us our own weakness. I say that that point will tend towards solution.

It has had other effects and other benefits. Mr. Tinkham could probably give you this better than I could cite it, but it taught us in this last summer at one time that the cabbage on the market was not worth the price of harvesting and hauling in. The farmer might have learned some of that from bitter experience, but with that Market News Service continuing, it showed that the market after a while had regained to the point where it would warrant cutting and bringing the cabbage into the market.

We all have that time on the farm or in the garden or in the orchard when we are doubtful as to whether or not the products will bring the actual cost of gathering and of the package or container in which they must necessarily be shipped, so that we are hesitant about which step to take; but this sort of service will tell us whether the markets, our local markets, will absorb them, and tell us whether or not there are other markets that are available.

Now there are thoughts in the minds of those in Washington, and some of us in this section have the belief, that this information could be disseminated on a more extensive basis to greater advantage; that if the people of Hartford were better informed of the condition of the peach market in Portland they would be in an advantageous position. If the men over in Albany, when they have their excess supply of some commodity, as they had the spinach, would learn that Springfield and Worcester were short on spinach it would enable them to ship that commodity in here and receive a better return from it. It would enable the farmers of Worcester, if they had the service in operation here, to ship over to Albany when they had the surplus and excess, knowing that Albany was short on that particular commodity.

So the plan, as it is being suggested and thought of at the present time, is this: there has been an agent in operation in Bridgeport, Connecticut, Providence, Rhode Island, Boston and Springfield, Massachusetts, and Albany, New York. There could be, to advantage, we believe, an agent placed in addition to these in New Haven, Hartford, Worcester, Portland, possibly Portsmouth or some other city, — a distributing point in New Hampshire, — and in Burlington, Vermont, linking up those different stations with a leased wire, and include on the circuit Bridgeport, New Haven, Hartford, Springfield, Worcester, Providence, Boston, Portsmouth, Portland, Burlington and Albany, — if you can imagine that geographical circle, — so that news would be disseminated every day, and by noon time you would know in Boston or in Worcester what peaches or spinach or apples or any other commodity were bringing in Portland or in Burlington. It would enable you to ship them off on that particular day, and have them there at the earliest possible moment to meet the needs.

Now, I have mentioned three cities which you will regard as being very limited from the standpoint of being market centers for locally grown products, — they are Portsmouth, Portland and Burlington. But they are to be considered and recognized as valuable distributing points for the products that we are growing here in New England. You take the coast section in New Hampshire: although it is only 18 or 20 miles in length, I am told that there are upwards of a quarter of a million people there in the summer season.

You go into the Portland section and you find it distributing along the entire coast of Maine, which is 300 or 400 miles in length, and shipping up into the White Mountain sections, which are densely populated with the tourist element throughout the entire summer months.

You go to Burlington, Vermont, and you find them supplying the tourists and the summer resort people of the Lake Champlain section, into the Green Mountains, and the western section of the White Mountains.

Now, then, if we were to know there was a scarcity of these products, or that peaches were bringing $1.75 in any one of those cities and low prices here, could we not profitably ship

to those markets and take advantage of those prices and give some benefit to the people of that section who are without the commodity through a large part of the season? At the present time you know as well as I do that their supplies are being shipped largely from Boston and from Albany, those two centers getting the entire benefit, and if our Springfield products go up to Portland, they go to Boston first, are handled there, — at expense again, — and then go on to Portland, after some considerable profit has been added to them.

Now, the idea is that there will be some bringing together of these two factors, — the buyers of Portland and the shippers of Springfield and Worcester and the other cities named; and we believe that that is an entirely feasible and workable plan, and that plan is being suggested and considered by your State Department and by the Bureau of Markets in Washington, and we hope it will be brought about during the coming spring.

Some of you may say, "How can we secure that service for Worcester or for some other of these cities that have not yet secured it?" You can secure it by working through your local organization and in co-operation with your State leaders in marketing and with the Bureau of Markets at Washington. There was an amount of money available a short while ago which is available until June 30, and certain cities will be chosen where that service will be placed; and I will warrant, from the experience which I have previously had in that department, that the service will be placed in the city where there is the greatest demand for it. They will not go out into the sections, as I stated a while ago, where they are unorganized. They will look for the organized effort, so that they may show the best results for the expenditure of money. They want to show the results with the appropriations as they are used. So your men of Worcester might be able to secure such an agent here who would be able to give you that information daily, and who would put you in touch with those different cities.

Providence has been standing one-half the expense. The other cities are standing one-half the expense on the local markets for that reporting service. The men of Providence and the men of every other city with whom I have talked concerning the work say that it is worth every dollar they have

invested, and the people of Providence said, in the middle of last June, that they had been well repaid for their expenditure that early in the season, and they have secured the benefits continuously from that time on.

Now, I would be glad to answer any questions you may ask concerning this particular line of work.

Mr. Wheeler. One thing that Mr. Selby said struck me as being very forcible in this matter, and that is, if we are going to get the Market News Service from the government, or help from the government, the government is going to take it up in those sections where you are organized, — where something has already been done. It strikes me as being a very strong plea for a State Department of Markets. We have at the present time in this State no definite State organization of markets to help the practical farmer; and in talking the matter over with the Department in Washington, and with the secretary of agriculture, I gained the same impression exactly from them, — that they are going to help the sections that are organized in order to work through a whole department rather than a lot of small cities and towns, or semi-private or semi-public organizations. It seems to me, if we are going to get the benefit of this work, that it is our duty here to make a good organization, the first step in order to work with the government in this work, because it is so important. It impressed me, as Mr. Selby said this morning, that the greater importance of this work is going to be felt as we increase our production.

Mr. William Swan. What Mr. Selby said about the News Service carrying all this market news on the leased wire calls attention to the fact that the Associated Press at the present time has all these different towns he has suggested, or cities, already hooked on one great leased wire system, perhaps centering in Boston. Nevertheless, they are all gathered every single hour of the day. Possibly the Associated Press might be appealed to to carry this Market News, say, twice a day, giving out the current report of the different products and the sales in the different cities, so that all you men might find them in the afternoon or morning papers, rather than depend upon the uncertainties, at the present time, in the United States mail. Something at

this time might possibly be done instead of loading the wires of the Associated Press with long tales of crime and tragedy not at all necessary to our daily life; and it seems to me that the officers of the Associated Press in Boston might be appealed to to carry these market reports just the same as they do the stock market and grain market and produce market, which they send daily to the "Burlington Free Press" and other New England papers.

Mr. Selby. I will say to that, that the leased wire is used in connection with the car-lot shipments that I referred to awhile ago. There is one circuit covering Philadelphia, New York and Boston; and another one covering the western circuit out to Chicago, including St. Louis and Omaha as the farthest western points, and information that is required regarding these commodities takes the wire for ten hours of the day. It is the hardest thing to get a message over those wires because they are constantly busy with the work necessitated by reporting from all the different cities. It is practically an independent proposition, and will have to be, from the volume of it.

Mr. Hodgkins. I would like to ask Mr. Selby if it would be practicable for us by an organized attempt — if this information could not be gotten for some central point in each county for the time being; if by paying for this service they could not get that for the benefit of the particular section of the county.

Mr. Selby. Now, Mr. Tinkham might be able to answer in that line, because the work you refer to deals more directly with the State work. But this information was disseminated, I believe, from Providence to a number of points over the telephone by their merely paying the charges; the information has been given out to Springfield, and it has been telephoned to other parts radiating from Springfield by their simply paying the telephone charges. The Springfield Market Gardeners have been assuming the other half of the obligation in co-operation with the United States government for the service in that city.

Mr. Flood. Mr. Selby has stated that it was possible for the farmers of, perhaps, Springfield and other places to know at noon as to the market conditions in other centers the previous day. I would like to ask him if it would be practicable, on perishable goods, to know at that time if they could be shipped, for instance, from Hartford to Portland?

Mr. Selby. In our own farm experience in Jersey and southern Pennsylvania, at many times in the height of the season we bring our loads of peaches to the market without the least bit of knowledge as to how they will be disposed of. They are ripe, mature and must be shipped somewhere, and through this News Service we are finding the cities where we believe there will be the best demand, judging from the receipts reported in those cities and from the price they are paying. The information is received by noon the same day, not by noon the following day.

Mr. Flood. I see. I thought it was the previous day.

Mr. Selby. No. The produce markets are very early in nearly every instance, and the bulletins you men may receive from the Boston office, if you are on the mailing list there, show the prices. The bulletin is released at noon that day, showing the price of the various products on that morning's market, so that you can secure that information by telephoning that office, or, if you are in the city, receive it from the office. You receive it by mail the following day.

Mr. Tinkham. On our market, very often any farmer that belongs to the association can telephone in any time after 7 o'clock in the morning and learn what the same articles were sold for that morning in Boston. He can then ship during that day to Boston. If there were facilities for handling it here in Worcester we could as readily ship here because we know for about what they are selling here by 7 o'clock in the morning — what they are sold for that morning. That may be a little clearer statement of it. Any person belonging to the association can telephone in to the headquarters any time in the morning — I said 7: I might as well say 6 — and find out what any of the local, any of the common, products are selling for in Boston, New York, Springfield. We know whether we can ship to Providence that afternoon or whether we had better ship to Boston. Very often we do ship many truck loads into Boston. I think we tried Worcester one or twice. That has been the benefit to the man on the farm, — the morning service in these other cities at that time.

A Member. Mr. Tinkham seems to have the information, so far as Providence is concerned, but in Worcester we haven't

any way of getting any information. It seems to me something of this kind would be good, — an information bureau. I know, as a member of the Worcester Market Gardeners, we tried to get something of this sort last year, but could not finance it. As a matter of fact, we grow our stock and take it in to the commission houses. From the majority or most of them we try to get a line as to what the stuff is bringing. They say they are trying to get such and such a price; some get it, some don't. There seems to be a good deal of competition among the wholesalers dickering with our stuff at our expense. If in some way they could keep the price up where it belongs, so we could derive benefit, it would be well.

Mr. Wheeler. Isn't there, Mr. Selby, quite a danger that unless this Market News is disseminated from one point, — isn't there danger, say, if the news goes out in the morning that Worcester is short of a certain article, that every farmer in the section would ship into Worcester and spoil the market there; therefore, would it not be much better if the news wasn't made too general, but that the central point be made to reach a group of farmers near enough to Worcester to take care of that place; reach Springfield, and take care of that place, rather than spread this around so there is no definite control of shipments.

Mr. Selby. That is some of the work that was before the agent in Providence and other cities this past season. They found that Boston would be paying a high price for a certain article or articles, and the tendency would be to rush there. Of course, Boston could stand quite a good volume.

That brings in one point I failed to mention before, — that the Market News Service tells the volume that is in transit to any particular market. The reports that I have in my pocket show how many cars of potatoes are moving from the other sections into Boston and the other cities of the country. In the same way, reports could be secured from the railroad, telling what volume was on the way into Worcester. Of course, your motor trucks overcome a portion of that too. It puts the responsibility for that important feature largely on the local agent, so that he will not induce too many of them to ship to some point, but rather those who inquire the earliest.

Mr. Wheeler. The point that I want to make here, then, is that your news had better go to the agent rather than to every farmer. You should take care of the local agent rather than try to spread that news all over the country.

Mr. Selby. That is the tendency, but when those farmers from Providence would telephone into the office at 5 or 6 o'clock in the morning, and find out that the Boston market was strong, they would, in all probability, make the statement to the representative there that they were going to ship some over, and he could check up in that way. Of course, you can handle that better through your local organization if you are properly organized for the distribution of those products. That, of course, is simply another feature of the work on which I am talking all the time, — our Eastern States project.

Mr. Tinkham. I would like to make that statement as a fact. We always telephone to one headquarters. Sometimes they will say, "Here, I guess I will come along in." "Hold on, you had better go slow, there is a lot headed in that way." That goes with the information every day, every time you ask on a well-organized market. Then, again, one other thing you do not understand, as well. The agent there also knows it at about that time, — 7 o'clock, 8 o'clock. He knows approximately what the same farmer is going to have the next morning on the same market. We know not exactly, but we know approximately, the quantity of any one article that will be on our market the next day, as well as what is that day and what was the day before.

Mr. Taylor. I must emphasize what Mr. Selby said, because I have met with experience in that line, in view of the fact that I started the work in Providence. The feature that has been brought up, whether you get too much into your one market or not, I would not worry about. Boston can absorb, as every one knows, a considerable quantity, and what one section might turn into it wouldn't amount to much, — or absorb quite enough for the present time. In the Rhode Island section — I speak of that, knowing more about it — there are only three or four or five men who have automobile trucks that they can send, or spare to send, into the Boston market at the present time. They require a certain amount of trucks

to take care of their local business. What goes away from Providence to Boston and Worcester and Springfield they must have extra trucks to take care of, or have some one come and take care of it. Then another feature, that is, the advertising value of these market reports. Mr. Tinkham can tell you, I think, what the editor of the "Providence Journal" told him the space would cost them if they put it in as advertising. I think it was around $25,000, wasn't it, Mr. Tinkham?

Mr. Tinkham. A large sum.

Mr. Taylor. He said, "Put a government stamp on it and it won't cost you anything," — between $500 and $600 instead of $25,000 for the advertising space. Then, again, the first day that report appeared in Providence the Providence market was stuck on rhubarb. The retail price was 4 or 5 cents a pound, and the wholesale price, 1 and 1½, only about 3,600 pounds a day coming into the market. That was on Tuesday, — the Monday market. By the following Saturday market there was brought into Providence 10,600 pounds, over three times as much as there had been, and the price was the same, wholesale. The price was 3 cents a pound retail; in a few cases, 2½ in larger quantities than 1 pound in the stores. There hadn't been any change in the weather justifying such a condition in the market; simply the fact there was no outlet for the stuff because of the lack of advertising. And where was that outlet? Within twenty-four hours after the first notice in the Providence paper a large shipment was sent to Worcester from Providence. The same thing happened in the tomato season. There were times when as much as three truck loads of tomatoes left Providence bound for Worcester, in addition to what went to Boston, — from Providence to Boston, because we were carting to Boston in competition with your own growers. There is only one way to cure that, — it is rather an old one. I suppose there was good reason for the Worcester people being sore on the Providence people; that is, do it yourselves. There may be a time when they can reverse the problem. But as far as flooding one particular market, there isn't going to be any trouble with that for quite a while. I think we have a fairly good system in Providence. When peas were a dollar a bushel on the market there was a man on the Provi-

dence market who sold his own produce, — whatever it was I could not tell you, — and loaded up on the peas at $1 a bushel. He lived within 20 miles of Taunton, a city of 20,000 people, with 20 or 25 good stores, and he brought those peas there and sold them for $2.25 a bushel, and made more out of that deal that he made in peas than he did on his own production, because the distribution wasn't being handled properly. If the people in Taunton had been able to buy those peas at $1.50 a bushel they probably would have bought a great many more than they did at $2.25.

The Commonwealth of Massachusetts

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 77.
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THE WORK OF THE FEDERAL LAND BANK.

LEONARD G. ROBINSON.

From the Sixty-fifth Annual Report of the Massachusetts State Board of Agriculture.

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THE WORK OF THE FEDERAL LAND BANK.

LEONARD G. ROBINSON, PRESIDENT FEDERAL LAND BANK, SPRINGFIELD, MASSACHUSETTS.

Last spring, when this nation was submarined into the world war, President Wilson made a stirring appeal to the loyalty and patriotism of the American people. To the farmers he said: —

> I take the liberty, therefore, of addressing this word to the farmers of the country, and to all who work on the farms. The supreme need of our own nation and of the nations with which we are co-operating is an abundance of supplies, and especially of foodstuffs. The importance of an adequate food supply, especially for the present year, is superlative. Without abundant food, alike for the armies and the peoples now at war, the whole great enterprise upon which we have embarked will break down and fail.
>
> The world's food reserves are low. Not only during the present emergency, but for some time after peace shall have come, both our own people and a large proportion of the people of Europe must rely upon the harvest of America. Upon the farmer of this country, therefore, in large measure rests the fate of the war and the fate of the nation.

The President's appeal has electrified the country. It struck a responsive chord in every heart, and the American people rose as one to the needs of the situation. The response of the farmers was immediate and effective. Last year's food production tells the story.

It is a story without words. Words are inadequate to describe the almost insurmountable obstacles that the farmer had overcome, and the great sacrifices he had to make to do *his bit*. Shortage of labor, scarcity of seeds and fertilizers, and the high cost of all instruments of production were only some of the difficulties he had to face. There is a mistaken notion — believed in by many who ought to know better — that, because of the high prices of farm products, the farmers made

fortunes last year and are wallowing in wealth. They do not stop to consider that what the farmer buys has risen higher than what he sells.

No. It was not the profits that induced the farmer to do his utmost. It was his patriotism. The American farmer has never failed in his devotion and patriotism. He never has failed to respond with his services, with his resources and with his life when the country needed them. His patriotism is clearly reflected in the great number of young men from our farms who voluntarily answered the call to the colors in our army and navy. It was shown in his liberal support of the two great Liberty Loans. It was the same unadulterated patriotism that made his response to the President's appeal so effective last year.

Apart from the serious problems I have mentioned, which the American farmer is facing to-day, there is another problem of age-long standing, but which in recent years has caused a great deal of discussion and loose talk. I have reference to the financial problem.

When the European war broke out, in 1914, the farmers in this country were given a taste of the precariousness of their financial position. Mortgages were not renewed, or were called in, and even those whose experience was not quite so serious were kept on the anxious seat, not knowing what would come next. By 1915 the money market eased up. In sections where the greatest financial stringency prevailed in 1914, and where farm mortgages were unobtainable or obtained only with the greatest difficulty, there was, in 1915, a plethora of money, and banks and private investors were only too glad to lend it out on farm mortgages. In a report published that year, I said: —

> Gratifying as the situation may appear on its face, these conditions are not without grave possibilities. These mortgages are largely demand or short-term mortgages. Should a financial stringency such as that of last year recur many of these mortgages would be called in, and many a solvent farmer, whose security is gilt-edged and who meets his obligations promptly, would be forced to the wall. The call loan may have its functions, but not on the farm. It is this fast and loose financial game, to which our farm industry is subjected, that makes the reorganization of rural credits in the United States most imperative.

The needed reorganization of our farm mortgage machinery came none too soon. After an agitation of several years Congress passed the Federal Farm Loan Act. It was signed by the President on July 17, 1916. This act has appropriately been called the Magna Charta of American agriculture, — the charter that has liberated the American farmer from bondage. This act has been subjected to much criticism both by friends and enemies. It has been called a Wall Street measure. It has also been called socialistic, paternalistic and what not. But to-day sentiment has changed very considerably in favor of the Federal Farm Loan Act. Excepting in circles which are clearly irreconcilable, all doubt that may have been entertained as to the Federal farm loan system has by this time given way to the realization that the system is here to stay.

Bankers who had felt that the system was unnecessary, at least in their own vicinity, have since found it most vitally necessary to their own stability, and to the prosperity of the communities which they serve. Country bankers, who feared that the Land Banks would interfere with their business, find them, on the contrary, most helpful, and are only too glad to co-operate and assist in the extension of the system in their territory. The President of a national bank in a city in western New York came a distance of over 500 miles to see how his bank could assist in organizing a National Farm Loan Association. Another bank in southern New Jersey is actually expending about $300 in boosting the farm loan system among the farmers in its country. I could recount numerous other instances of the whole-hearted co-operation the Land Bank of Springfield is receiving from national banks, State banks, trust companies, and private banks.

It was not, however, until our entry into the war that a keen realization of the true functions of the Federal farm loan system was brought home to our country bankers. When the Land Banks started, late last spring, financial conditions were never more favorable. To-day it is the very reverse. In so far as mortgages are concerned, especially farm mortgages, the situation has seldom been so uncertain. There is scarcely a national or State bank in the United States which is not a

borrower. Savings banks are not making any new loans, and are drawing in their old ones, while life insurance companies have exhausted their available funds for some months to come. The third Liberty Loan, perhaps larger than either of its predecessors, will be floated shortly. Our financial institutions must hold themselves in readiness, and are less in a position to relieve the farm mortgage situation, while the needs of the farmer were never greater.

The importance of the rôle played by the farm loan system in financing our farmers is but faintly indicated in the operations of the Land Banks. To the first of this month — that is, in less than nine months — the applications for loans from farmers aggregated a total of about $250,000,000. Of this, about $125,000,000 has thus far been approved, and about $30,000,000 has actually been loaned out. Even in this district, where it was claimed that the need of the system was not apparent, the Federal Land Bank of Springfield has received applications for loans upwards of $7,000,000, has approved loans aggregating nearly $4,000,000 and, actually furnished the farmers of this district $1,126,000 for very urgent purposes.

Alongside of the needs of American agriculture these figures may not appear very impressive. But it must be borne in mind that the Land Banks are doing pioneering work. As such, we had to face most of the disappointments, bear many of the burdens, and suffer some of the hardships that fall to the lot of every true pioneer. With the Federal Farm Loan Act in one hand, a charter in the other hand, and the blessings of our friends upon our heads, we set out to construct what is destined to become the greatest system of agricultural finance in the world. Unlike the Federal reserve system, which had some 7,000 well-organized and well-managed member banks to build on, we had to organize not only our own machinery, but our member banks — the National Farm Loan associations — before we could begin business. It was a slow process at best. There have been crossed wires, loose ends and many unavoidable delays. With all that it is gratifying to be able to say that we have made progress. As we are getting into our stride the various steps of handling applications for loans will be

accelerated and speeded up. Our best energies are being exerted so as to make it possible for the farmers to get their loans in the shortest possible time and at the lowest possible cost.

Of course the present financial situation has created a new problem for the Land Banks in the marketing of their bonds, upon which they must depend for their funds to lend to the farmers. The security market is all shot to pieces, and the best of bonds, including government, municipal and railroad, are being sold at a discount or go begging. This has made it difficult for the Land Banks to market their bonds as readily as before, and has given rise to a great deal of nonsensical comment upon the farm loan system and upon the work of the Land Banks. The appeal to Congress for relief in the present emergency has been construed as a confession of failure. But this is an extraordinary situation, and had to be met in an extraordinary way. Nobody finds fault with our financing our allies. Nobody finds fault with our financing our war industries. Nobody finds fault with our financing our railroads. Why, then, should we not finance our food producers?

That the railroads cannot finance themselves is not their fault. The same is true of the farm loan system. It is not the fault of the system, nor the fault of the Land Banks, nor the fault of anybody. The situation was created by the terrible ordeal which this country is facing to-day in its struggle for righteousness among nations.

The Federal farm loan bonds are a prime security. There is not a bond in the market that is hedged around with so many safeguards, or that has so much substantial security underlying it. There is little doubt but that the Land Banks will be able to dispose of their bonds if given time and when the financial situation takes a more favorable turn. Before the Second Liberty Loan was floated the demand for farm loan bonds far exceeded the supply. Those bonds are legal investments for savings banks in over twenty of our States. I regret that the Commonwealth of Massachusetts is not among them. But I sincerely hope that its patriotism will soon bring Massachusetts in line.

There is little doubt in my mind that the money will be

forthcoming in one way or another, and that our food producers will not be handicapped because of the lack of adequate funds. I am not worried in the least about the financial situation.

But I am gravely concerned about the farm labor situation. Upon no industry has the war made such inroads as upon our farms. Perhaps no part of our population has furnished so many voluntary enlistments as our farming population. Of this we have reason to be proud. But this and the draft has crippled our farms.

It is not exemption that is wanted. The farmer would be the last to claim exemption as such. Exemption is repugnant to the spirit of leveling democracy, for which we are fighting. Have the little ones who suffered for the want of coal during the Arctic weather we had recently been exempt? Who can say that in their suffering and privations they are not doing just as much war service as our brave men in the trenches.

What is wanted is not exemption, but a more comprehensive extension of the selective draft, so that everybody will have to do *his bit* and *his best* toward winning this war. It is not the French *poilu* nor the British *Tommy* that halted the Hun hordes on the western front. It is the men who are too old or too young or physically too unfit, the women and the children, who did it.

Draft the young men on the farms, by all means, but assign them to such tasks as will best serve the interests of the country. Draft the young men in the city and put them, too, where their services are most needed. Draft the school children above the ages of fourteen. Close the schools and colleges March 1 instead of July 1. There is very little studying during these months. It will not lower our educational standards. It will make better men and women out of 3,000,000 boys and girls, young men and young women, by making them perform useful war service in the office, in the factory and on the farm.

As I have said, I am not at all fearful of the financial situation in so far as our farmers are concerned. But the labor situation is most discouraging. It is only the drafting of every man, woman and child into the national service that can relieve the situation.

Mr. Ford. I would like to be informed as to what a man must do, and how it must be done, to avail himself of this money?

Mr. Robinson. The Federal Farm Loan Act is quite specific on the subject. We cannot deal with borrowers directly. We can only deal with them through an organization of borrowers as intermediary. Now, the first thing to do is to get your organization; get at least ten farmers together and organize them — form them into a corporation. To do it in accordance with the most technical provisions of the Federal Farm Loan Act, let me tell you, is no joke. It has taken a great deal of time and has cost us a lot of money to work out the method. If it had not been for these requisites of having an association to deal with we could have started lending money to farmers the first day we organized. Now, first organize your association. Then let the association — which has a loan committee of three members — go and examine every farm. Then let the board of directors of the association approve every one of those loans; and then you are not through. You send your applications — each one of the applications — with the articles of incorporation to the Land Bank. The Land Bank must then send its Land Bank appraiser — who is an official of the United States — who inspects the farms, and when he comes back the board of directors of the Land Bank take action, and if they approve all those loans, and find that the papers are all correct, they are forwarded, — the papers are forwarded to Washington to the Federal Farm Loan Board for approval and a charter, and we cannot close any loans until the charter is granted. Now, of course, it looks quite formidable, but I will tell you something. We have cut down many of the short corners and a lot of red tape and we have speeded up our work, and I think that we have reduced the making of a loan within the last three months by half. I think we can do better than that, but it takes a little while to do it. Does that answer your question, Mr. Ford?

Mr. Ford. Yes.

Mr. Newkirk. I think there was one thing you omitted, and that was, after the association was formed, if another

application came in, they did not have to go through all that red tape.

Mr. ROBINSON. You tell them, Mr. Newkirk.

Mr. NEWKIRK. Well, after this association is formed, then if there are other applicants who wish to come in to the association and get a loan, they do not have to go through all that red tape that the organization did. They just make their application to their officers, and it is filed right into the office and pushed through with much more rapidity than the charter member organization.

Mr. FORD. I would like to ask you, Mr. President, is it impossible for a man in, we will say, the town of Dalton to go this morning and borrow money on a farm to be used as a farming operation unless there has been an organization of ten.

Mr. NEWKIRK. Yes.

Mr. FORD. I suppose there is an organization in Pittsfield.

Mr. NEWKIRK. Yes, there is; there is supposed to be an organization in about every county. There is an organization in Pittsfield, one in Greenfield, Shelburne, Northampton, Enfield. Those organizations are already in that western vicinity there, and you could apply to any one of those organizations and send in your application, and it would be acted upon and put through at once.

Mr. WHEELER. I would like to ask Mr. Robinson if he believes in the proposition that the credit of the bank should be extended direct to the farmers, so the farmers could apply directly without going through the loan association.

Mr. ROBINSON. I will make a confession, Mr. Wheeler. When the act was before Congress I favored that very step. I foresaw that the need of an organization of farmers as a preliminary to getting loans would take time. But these organizations, these formal associations have worked out so well, that although it did of necessity take more time than it otherwise would for making a loan direct, I wouldn't for a minute advocate, at this stage of the game, the abolition of these National Farm Loan associations.

Mr. PARSONS. I would like to inquire the rate of interest.

Mr. ROBINSON. That is a very sore spot you touch. Our

rate of interest when we started was 5 per cent, and we had to raise it to $5\frac{1}{2}$. There was some doubt in Washington, when we first determined to have our loans at 5 per cent, as to the wisdom of that step, but we felt that we ought to try, and I firmly believe if it had not been for this war we could have put it through without any difficulty. Then you see the Germans took it into their heads to sink our ships, and we had to raise our rate to $5\frac{1}{2}$ per cent.

Mr. Parsons. The reason I asked this question was that the savings banks have lately increased their rate from 5 to $5\frac{1}{2}$. I was wondering if the farmers could make any money by changing.

Mr. B. W. Potter. I would like to ask if it isn't true that if a person wants to join this organization in order to get a loan he hasn't got to buy a lot of shares; and if he hasn't got to be responsible for all the losses — his share of the losses — that may take place on the mortgages that are put up.

Mr. Robinson. Each borrower must subscribe to the shares of the association to the extent of $5 for each hundred dollars he borrows. In addition he is only liable to the extent of that much money again, that is, double liability, just as a shareholder or stockholder in a national bank is; and that is the extent of the liability of any one who joins the association, and no more. We hope when we get going and begin making money that we are going to pay dividends on our shares. It was only, I think, yesterday that the Federal Reserve Bank of New York went into the dividend class among reserve banks after several years' operation. It will take a little while, but I think in time we are going to pay dividends on our shares, just as other banking institutions do. Of course, as soon as a man pays his loan his shares are retired, and he gets his money back. It isn't a permanent gift of any kind. It is simply a purchase of shares, on which we hope to pay dividends, and which is only to remain in the Land Bank as long as the loan is alive. After you pay off your loan, no matter when, you cannot keep your shares in there even if you want to. You have got to take them out.

Mr. B. W. Potter. I should also like to ask what expense it would be to the applicant to get his loan. I made some

inquiries here at Worcester and I find, if I am correctly informed, that it would take in the neighborhood of $100 for the applicant for the expenses of getting the loan. In the first place, you have got to join this local association and become responsible for the two shares, at any rate. Then three appraisers from the local association must appraise the property. Then the other appraiser comes from Springfield and he has got to appraise it. If it is distant, and he has to travel — for instance, if he went to Maine — it would be quite an expense to pay his expenses down and back. And then the examination of the title and the papers that the lawyers would make out would cost $50 or $60 more. So I assume a man could not get a loan under $100, probably, for the expenses of the loan.

Mr. Robinson. It is pretty hard to say just what the cost would be to a man to get a loan; but there is no expense in the examination of a man's farm by the loan Committee. In many associations no charge was made whatever, and the loan committee served gratis. In some associations the loan Committee makes a nominal charge, which doesn't amount to very much, for the expenses. Now, the appraisal made by the Land Bank is borne by the bank, not by the borrower; so that disposes of that part of it. The real expense, the large expense, is, of course, the examination of title, and that varies with the practice of the part of the country where the farm happens to be. I know that in Massachusetts — certain parts of Massachusetts, at any rate, and in the northern tier of States — the cost is normal, but not very large. On the other hand, say, take certain parts of New York and New Jersey, and it is high, unfortunately. We are doing our best to keep these attorneys in check, and we are planning — and I hope in time we will be able to do it — to have our own staff of attorneys on salary to look after the titles, so that we can reduce the cost of examination of titles to reasonable proportions. I must admit that in some cases we found that there were exorbitant charges made by attorneys, and put our foot down on them. We wouldn't let those attorneys do any more of our work, but we are trying to stamp this out as rapidly as we can.

Mr. Ellsworth. In regard to the bonds, what interest is being paid, and how many of the western States have legalized them for savings banks and other banks?

Mr. Robinson. The bonds — that is, the last few issues of bonds — bore the rate of $4\frac{1}{2}$ per cent. They were sold to the public at $101\frac{1}{8}$, which placed it on somewhat like a $4\frac{1}{4}$ basis for five years. Just what the rate of interest will be in the future it is hard to say, but we hope we will be able to maintain, — especially with the government underwriting, which is certain to come, of $100,000,000, — we will be able to maintain the $4\frac{1}{2}$ per cent bonds and will not have to increase our interest rate on those bonds. As far as the number of States that have legalized the farm loan bonds as savings bank investments I could not give you all the names. I know there are something like 23, of which three are in this district, that is, Maine, New Hampshire and New Jersey. The others haven't yet come into line. When I sat down Mr. Holland, president of the Plymouth County Trust Company, suggested that I had better say something about amortization. When you consider that a loan you have from a bank or private investor is likely to be called in at any time, and then you have to seek another man to take your mortgage, each time you do this it means expense, — new lawyers, new bonuses or what not. Now, here you have a loan for thirty-six years, and you are relieved of all worry and of all expense for that length of time. Besides, you repay your loan in small annual annuities or payments, — which they call amortization, — and by increasing your rate, that is, adding to the interest rate of 5 or $5\frac{1}{2}$ per cent, 1 per cent more, your loan will be repaid, principal and interest, in the space of thirty-six years. So when you take everything into account you will find, — even if the rate of interest on the loan of the Land Bank is as high or perhaps a little higher than those mortgages received from other sources, — you will find that in the end it is much cheaper.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 78.

January, 1918.

SHORT-TIME CREDIT FOR FARMERS.

CHARLES P. HOLLAND.

FROM THE SIXTY-FIFTH ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
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1918.

Publication of this Document
approved by the
Supervisor of Administration.

SHORT-TIME CREDIT FOR FARMERS.

CHARLES P. HOLLAND, PRESIDENT PLYMOUTH COUNTY TRUST COMPANY, BROCKTON.

This department has for its object the application of business methods to the business of agriculture. We believe if the farmers are lax in their methods, or are failing to use all available means for improving their conditions, the fault is in large part with the banker.

Acting upon this conception of the duty and opportunity for community service to this most important element in every community, the Plymouth County Trust Company has for the past three years employed two young men, graduates of the Massachusetts Agricultural College, for the purpose of studying the needs of the farmers in our city and vicinity, presenting these needs to the directors of the bank, and so preparing the way for intelligent and business-like application of credits to the solution of their problems.

The following report of the agricultural agent to the directors shows in outline the result of our endeavor for two years: —

Visits made,	2,166
Office calls,	2,586
Telephone calls,	1,870
Letters written,	2,643
Miles traveled by autos,	35,315
Meetings addressed,	87
Approximate audiences at meetings,	2,942

We have brought into the city 24 cars of grain, 29 cars of hay, 11 cars of cows (300 head, worth approximately $55,200), 2 pure-bred bulls, distributed around 1,000 pigs, and exhibited last year 41 pigs and 7 cows at the Brockton Fair, and 4 pigs at the National Dairy Show at Springfield.

We distributed 28 high-grade heifers to boys and girls, organized 3 co-operative buying associations, supported a home economics advisor and a modern tenement in the Lithuanian district, where cooking lessons are given twice a week, and published a cook book in Lithuanian, of which we have distributed 1,000 copies.

Our pig club was one of the first activities and has proved a very valuable and educational work. Our second year's membership was secured almost wholly by advertising on the part of members of the previous year's club. The boys and girls assemble in a vacant lot in the city, where the pigs are distributed to them. They pay for them by notes with interest, which the bank accepts without other security.

Most of the pigs were taken home in bags. One of the interesting sights was that of over 75 boys and girls sitting on the sidewalk curbing waiting for the distribution. One electric car going out of the city contained 38 pigs and their owners.

This last summer, with approximately 500 pigs distributed throughout the vicinity, in order to advise and assist the children in their endeavors the services of a third man were required.

A prize of $100 is offered to the boy or girl producing the best result in pig raising, this money to be available only in case the winner should go to some agricultural college or domestic science school. In this way we have endeavored to stimulate a desire on the part of the child for an agricultural education.

The future of the boy who won the prize the first year has been wholly changed. He had planned to leave school and go to work, but because of his success in the competition he has decided to go to an agricultural college, and already has a small bank account to his credit for that use. Last year a girl of Russian parents and a most unpronounceable name won the prize.

Our club produced over 67,000 pounds of pork, which had a market value of more than $9,000. The average profit per pig was $6.58, making a total profit to the members of $2,500.

Our dairy project by its growth seems to certify as to its value. Above we have given the number of high-grade cattle brought into this section. Of this number 34 are pure bred, and we find a growing demand for such stock.

One man who has 7 of our cows, out of a total of 13 in his herd, has the highest producing herd of grade cattle in our vicinity. Practically all who have kept records have made an average of over 10,000 pounds of milk per cow per year. The average production in Massachusetts is somewhere near 5,000 pounds. A few of our grade cows have given over 80 pounds of milk per day; several over 70 pounds. These records were practically unknown before we began shipping in this class of stock.

For a long time farmers have been urged to buy higher producing cows, feed more balanced rations, keep records and to know whether or not each individual cow was profitable. We have helped to accomplish these things in numerous cases.

After a year of thorough investigation and endeavor to convince the dairy men of the wasteful competitive delivery of Brockton's daily supply of milk, some of the over-lapping routes have been abolished. Under the title of the Producers' Dairy Company 88 farmers have combined their entire output of milk, and are handling it through a central pasteurizing and delivery plant.

The company is capitalized for $150,000, with $100,000 in common stock and the remainder in preferred. The initial subscription totaled $50,000.

Contracts for building and equipping a model dairy plant have been let, and completion of the building is expected some time in November.

The business of the company will in time be extended to include the production of every commodity that milk or cream will make, and the marketing of the combined produce of all the farms; besides which, co-operative buying will be extended to practically cover the whole field of purchasable supplies.

Our co-operative buying is a very valuable feature. Since a year ago February there have been bought in this way 33 cars of grain at an average saving to the farmer of about $5 per ton. Reckoning the car as containing 20 tons (and we have had several cars of 30 tons), this makes 660 tons at a saving of over $3,300. One farmer acknowledged that he had saved enough money to pay the wages of a hired man for a year. On the last 2 cars in Easton, aggregating 52 tons, there was a saving of over $8 per ton.

We have extended the co-operative buying to include hay, fertilizers and lime, and have saved about $5 per ton by this method on everything except the hay. There has been purchased by this means a total of 55 cars of supplies.

We also plan to purchase seeds and other farm supplies, having disposed of over 2,700 bushels of seed potatoes which were brought direct from Maine to be distributed in small lots to those interested in the home-garden project.

We have had a market gardener, who is a graduate of the Michigan Agricultural College, draw plans for a home garden, suggesting dates and varieties of vegetables, which, in his opinion, would be the best for this section. We have had 4,000 of these "Garden Manuals" printed and distributed in 12 shoe factories of this city holding meetings at the noon hour, and have addressed in this way over 2,000 men on the subject of home gardens.

The market gardener spoken about above was a young man to whom we advanced a credit of $300 two years ago when he was starting in business. Last year his net profit was $2,000, and he has been gracious enough to attribute his rapid advance to the assistance given him by this bank.

As a climax to our extensive home-garden campaign, we have established a community canning plant so that the natural surplus from the many gardens might in no way be wasted.

Produce for canning is received three days a week, and the canned goods are ready for distribution the next day. Everything is supplied and done at the plant except the initial washing and cutting. A charge of 7 cents a pint and 8 cents a quart is made, allowing a very noticeable saving in canning goods when glass jars alone are costing around 8 cents apiece.

In charge of the plant is a young man who has won several state prizes in home garden and canning work. Every spring we have assisted him in his garden work with a small loan. This year he covered the entire loan with his first contract sale of tomato plants. He is assisted at the canning plant by a Framingham Normal School girl and four others.

New people are constantly coming to us for advice about agricultural affairs, and we are urgently advising them to secure small places on the outskirts of the city wherever possible,

since we feel it is better for the community as a whole that as many of those citizens as can do so be self-supporting in the matter of vegetables and the like.

The fact that over $2,000,000 worth of food supplies were brought into the city of Brockton in one year will show that there is large need in this industrial center for more food to be raised at home.

We are showing the farmer how to keep cost accounts, how to make out statements, — in short, to know his business, both from the technical and from the business standpoint. Through this department we expect to reach every family who may be interested in farming or home gardening, and whenever such persons are found worthy small loans are made to be used for constructive work, or for improvements under the supervision of our agents.

The Commonwealth of Massachusetts.
STATE BOARD OF AGRICULTURE.

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What Organization Has Done for the Milk Business.

RICHARD PATTEE.

From the Sixty-fifth Annual Report of the Massachusetts State Board of Agriculture.

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WHAT ORGANIZATION HAS DONE FOR THE MILK BUSINESS.

RICHARD PATTEE, SECRETARY NEW ENGLAND MILK PRODUCERS' ASSOCIATION.

The successful operation of any plan or enterprise depends largely upon two things: first, the opportunity or necessity for the enterprise itself; second, the intelligence and enterprise of its management.

Recently an effort has been made to perfect an organization of milk producers on a New England-wide basis. Local organizations dealing with separate markets have appeared and disappeared. With a growing urban population, creating a constantly larger market for dairy products, there has been a decreasing rural population, a decreased proportion of dairy products, and an actual decrease in the number of cows in New England of nearly 20,000 per year, for a period of several years. The market-milk industry has been going from bad to worse. Attempts more or less successful in localities have been made for improvement, but there has been no cohesion between these separate attempts, and most of them have died aborning.

There are three classes of markets for milk in New England:

First. — That which depends largely on a far-distant supply brought by rail.

Second. — That which depends in part on a local supply supplemented by railroad shipments.

Third. — That entirely relying on local production.

Different conditions in different markets have led to different business practices on the part of dealers. Until within a year different dealers in the same market have had different practices with respect to the purchasing of their supply, according to the conditions in the locality where the supply was purchased. There has been no uniform system in the same market, or between markets, in the purchase of milk in New England. The same concern previous to August 1 may have

bought milk in a dozen different ways for one market, and no two buyers in a dozen markets might be buying the same way. Prices, methods of handling, credits, transportation, arrangements and other things with respect to the country end of the milk business were confusion thrice confounded. For illustration, a recent survey in New Hampshire by L. M. Davis of the Bureau of Markets, United States Department of Agriculture, shows that during the year 1916 four different dealers buying milk in New Hampshire paid, respectively, per 8½-quart can, 35.58, 34.25, 37.5 and 32.41 cents. What chance had the dealer who was paying 37½ cents for any competition with the dealer who bought milk in the same locality for less than 32½ cents?

In eastern Maine milk was bought largely by weight and test. In southern New Hampshire it was bought by the can without regard to test. In Maine, where milk was bought by weight and test, so much was paid for the butter fat and so much for the skim. In northern Vermont, where milk was bought by weight and test, the average price was paid for 3.7 or 4 per cent milk, with a premium for excess butter fat. There were thirteen different ways in which milk was bought for the Boston market.

In the matter of credits, some dealers paid every day, some every week, some semi-monthly, others monthly and some not at all.

It will be absolutely impossible in a statement of this character to convey any adequate idea of the confusion that existed in New England. It was the custom for the large dealers at certain times to announce the prices they would pay for milk during a subsequent period. This was sometimes done through a formal six months' contract, sometimes on a month to month basis, sometimes during the middle of the month, and sometimes at the end, but always the price was announced by the dealer, and the farmer could take it or leave it as he saw fit.

It is no wonder that under such a system, or lack of system, the industry was in a pitiably decadent condition. Every man making market milk was complaining of his losses and hoping to get out. Hundreds and hundreds of farmers had

tried it and quit, and the fellow who still stuck was an object of pity and solicitude.

The milk question became the subject of frequent controversies and discussions in public gatherings, Legislatures and the like. Newspaper agitation and other forms of publicity kept alive antagonism between producers, distributors and consumers. There was no recognition of a community of interest between the parties concerned. It was everybody for himself and the devil for us all.

As a result of some study of the whole situation a plan was devised for the organization of the industry along business lines, with the purpose of placing it on its feet and of protecting not only the dairy, but general agricultural interests, and encouraging the maintenance of live stock on New England farms through reasonable prices for live-stock products.

The question was what form such an organization should take. After considerable study and months of discussion a temporary voluntary organization was established under which over 8,000 men pledged themselves by their signatures to associate with others in a co-operative selling movement, through which the milk of all should be sold as the milk of one. It became necessary under the laws of Massachusetts to procure a special act under which to incorporate the organization as a co-operative marketing proposition. Under this form of incorporation the association has a legal existence, can own property, sue and be sued under its own name, and members are relieved of individual liability. It is limited by law in the expenditure of any profits that may accrue to their use in promoting the industry which it represents. It can never declare dividends to its members, however great its assets. It is divided roughly, corresponding to the counties of New England, into county associations, which in turn are divided for convenience into local groups, with a county and a local president and secretary in each case. In this way leaders, selected by the membership, in all localities are available through whom communication may be maintained with the central office. This arrangement furnishes workable machinery for close, intimate and quick communication between the central organization and its membership everywhere.

The association is supported by the payment of a $1 fee from every person who joins, and the payment of one-half of 1 per cent of the selling price of the members' dairy products. The per cent is largely collected through the dealers, who are instructed by the members to pay to the association whatever their percentage amounts to from the monthly milk check.

When one starts for a place the main thing is to get there. It does not make so much difference whether one goes in the front or the back door, so long as he is in the house. The future of an organization is to be determined by the service rendered, rather than by the method it employs; so the value of an organization can be best determined by its accomplishments. Some of us for years have been preaching the doctrine of foundation principles. We have held that price in itself was a secondary consideration; that the more important things were the proper adjustment of the foundations on which price was based. The first thing a man does when he builds a safe building is to go down into the ground. He is seemingly going the wrong way, but if he starts at the surface and builds up, the structure which was intended as a protection may become a menace. The only way it can be made to serve its purpose of protection and safety is to put under it a strong foundation.

Therefore it has been deemed important that the arrangements on which price was based be first established. Over a year ago the interstate commerce commission laid New England out in zones of 20 miles. No matter what price is set for milk it will vary each 20 miles, according to the varying cost of getting it to market.

The dealer will pay more for near-by milk over far-off milk to at least the extent the near-by milk costs less to get to market.

There is a psychological value in publicity. We have maintained that it is good public policy for the consumer to know what milk costs the distributor laid down in market per quart. The fact that the consumers know, not how much the farmer gets at his farm, but how much he gets delivered in the market, creates a friendliness between consumers and producers, and prevents an extortionate advance by the dealer over the price

the producer gets. In all the larger cities it was determined to establish prices on the basis of so much per quart delivered in the market.

It was impossible to carry into effect much of the association's program on April 1. Producers generally had expressed the desire for winter prices for summer milk. This meant an advance of approximately $1\frac{1}{2}$ cents over the average paid for milk in the corresponding months of the previous year, according to the best information that could be obtained. It was finally determined that an advance of $1\frac{1}{4}$ cents per quart should be made over the 1916 prices. This arrangement did not in the least alter or amend the inequalities and discriminations of former years as between individuals and localities; it simply perpetuated them on a higher basis. The 1st of August the association had grown to such strength that it was able to practically dictate a complete revision of the marketing system and the price at which milk should be sold. This price was fixed at 7 cents delivered in Boston. From the 7 cents was taken transportation charges and other expenditures necessary in delivering milk to Boston. These were: —

1. Hauling from Farm to Station. — The contractors had created a system under which hauling averaged to cost about $5.50 per ton. The producers whose milk was hauled paid at the rate of $3 a ton, the balance being taken out of the general price of milk. The association opposed this deduction, but allowed it for two months rather than disturb the then necessary hauling system. Under the arrangement of October 15 hauling charges have been entirely removed from the price of milk. It is now up to the producer to deliver his milk at the railroad station. If the contractor hauls it for him he has to pay the contractor whatever price is agreed between them, no part of the cost of hauling being taken out of the general price of milk in any zone.

2. Country Station Expense. — A large part of the milk of New England is collected by milk stations, where it is wholly or partially processed, is cared for and prepared for shipment and billed out in car lots, or otherwise, by the representative of the purchaser who owns the plant and equipment. Where such country milk stations are maintained they are a part of

the necessary expense of getting milk from that section to the market. In other places where a large volume of milk appears for direct shipment the dealers have employed a local agent to inspect and weigh the milk, bill it out and assist in loading. The services of this man are a part of the necessary expense in getting that milk to Boston. The charges for country milk stations and agents were allowed as a deduction from the price of all the milk in the zone where such stations or agents existed. Under this plan, wrong in principle and harmful in effect, up to April 1 the producers in a whole zone are paying for the operation of the milk stations in that zone, whether they have the service of such station or not, for instance; in the State of Maine there may not be a single milk station in the tenth zone, while in the State of New York there may be a dozen, but the Maine farmers are taking less for their milk to meet the expense of operating the milk stations in New York. The association believes in and is working toward the localization of milk station charges, in the belief that the cost of operating each station should be charged against the milk that passes through that station. If I could have my way it would appear as a specific charge on every milk bill. I hope the time will come when the farmers who pay for these stations will realize they are paying for them and want to own them.

3. Can Service. — It is a lamentable fact that if the three great milk companies of New England — the Hoods, the Whiting interests and Turner Center — should withdraw their cans from the milk service, thousands of tons of milk would perish in the country while hundreds of people in the city would be going without. These concerns absolutely control the only way in which this perishable commodity can be moved from its source of origin to the point of consumption. Neither the public nor the producer is protected under this arrangement. The dealers might almost as well own the cars. In years past one of the great wastes in the business has been the loss of tinware in the country. At present prices that loss has tremendously increased; no person is quite as careful of some other fellow's can as he is of his own. If the farmers owned or had to pay for each can they used less cans would

be required, and fewer would be used for sap and molasses. On the basis of sale delivered at market it was necessary to provide a system of containers for the shipment of milk. It was therefore arranged that an allowance of .0005 be made for the use of cans. It was impossible to distribute this cost equitably between the producers, the outer zone producers requiring much larger can service.

4. *Railroad Transportation.* — The transportation charges vary on the different lines of railroad entering Boston, but inasmuch as the vast majority of milk consumed is shipped on the Boston & Maine, or lines having joint rate arrangements with the Boston & Maine, the Boston & Maine Railroad rates were used as a basis on which transportation deductions should be figured, with the understanding that if any other railroad was actually used, rates on it should be allowed. The railroad rates not only vary in amount for 20 miles, but they vary according to the size of the container in interstate transportation. The arrangement with the dealers is that they shall pay the freight and deduct the actual amount from the producer's check. The association announces a price of so much a quart f.o.b. market, and then figures out the deductions, notifying the farmers in each zone what price per can or per hundred weight is awarded to him at his railroad station.

Early in the year market divisions of the main association were formed in five cities other than Boston, and committees of producers sending milk to those markets, with a member of the main association sitting in, established prices after more or less harmonious conferences with the dealers.

In nearly all places it was a new and not altogether welcome thing for the farmers to call in the dealers, and through a committee negotiate a trade for milk. But be it said to the credit of the dealers that nearly everywhere they have recognized that the old day of individual bargaining, the haphazard catch-as-catch-can trading, has passed. Gradually but surely they have come to see that their business as well as ours is being helped by the establishment of a system under which success in "trimming" the farmers is not the measure of success in handling milk, but rather it is efficiency in managing their part in the operation of distribution. In the outside

cities contract periods have been shifted to correspond with Boston practice, prices have followed very closely Boston prices, and the relationship between Boston and the rest of New England has been wonderfully cleared up by intercommunication.

In dollars and cents the increase of $1\frac{1}{4}$ cents per quart brought to the producers of New England something like $100,000 a week for the months of April, May, June and July. Just how much of this was due to organization must be a matter of conjecture. Intimate knowledge of the negotiations and of the first offers of the dealers leads me to believe that at least one-half the increase was directly due to the producers being to some extent organized, ready to fight for what they believed right, and represented by a committee they were ready to back up.

The slogan for the summer had been "winter price for summer milk," and the advance of $1\frac{1}{2}$ cents did not quite make it in some sections, due to the readjustment of the zones on a 20-mile basis. For example, the line between Manchester and Centre Barnstead, New Hampshire, had been in a one-price zone. Under the 20-mile system it divided into three, in that nearest Boston there was a slight increase in price over the winter schedule; in the middle section the price was practically the same as in winter; while in the outer circle there was a considerable reduction.

This breaking up of old price equalizations caused some confusion and misunderstanding. Time and printers ink, however, did much to iron out the troubles. But during the late, cold spring there appeared a very insistent demand for a price revision upward. Even though much milk had been contracted for on a six months' basis, and though the pastures were flush and production higher than normal, the association opened negotiations that resulted in an increase of practically a cent a quart over what had been agreed on in the spring for the months of August and September. But important as this increase was, it was of far less value than the general revision of the buying system. It was brought about that prices should be made as of market delivery from every part of New England; that deductions from the city price should be made represent-

ing the actual cost of moving milk from every railroad station; and that the price at such stations should be the price at the city less the actual cost of getting it there. In addition, a liberal extension of the territory where milk is bought on weight and test was made, and a uniform test basis of 3.5 per cent instead of 3.7 per cent to 4 per cent was established. The rate for butter fat was raised from 3 cents per point to $3\frac{1}{2}$ cents. Lesser reforms were accomplished, but the most sweeping revision and standardization of buying systems ever made in New England was made August 1, 1917. In fact, it was the only general revision ever made, for previously the system had, like Topsy, "just growed." Personally, I regard the reformation of the buying system as the most important and profitable work the organization has done for the dairy farmers of New England.

The history of recent activities is too familiar for rehearsal. Suffice it to say that though under pressure from local and Federal authorities we have once been held for two weeks without gains, and once set back a half cent for two months, subsequent developments have proven the wisdom of the association in both cases, and to-day New England milk producers are in our judgment far better off than they would have been had they defied authority, asserted their rights by main strength, and incurred the financial and other losses that would have followed a fight.

But what of the future. No wise man will value his accomplishments by the past alone. What he has done should fit him for doing more and better things. And in this view may we not for a moment consider the nature and importance of a few of the problems this organization of farmers must tackle and solve if it is to be hereafter worthy of the start it has made?

First. — Strong in every State, the Milk Producers Association should have a legislative policy in every State that would dovetail into the general scheme of marketing milk in the city centers. This program should include standard and uniform systems of sanitary inspection, weighing, sampling and testing, standardization, grading and the like.

Second. — The association should, by a well-managed and properly financed plan, continuously advertise the merits and

value of milk and milk products as a food. Strange to say, there is less space and effort given to the sale of this commodity at less than cost and less than value than there is to the sale of diamonds. If half the effort were made to sell milk that is made to sell beer, an industry that is worth while might be revived and a people made better.

Third. — The organized farmers must tackle and solve the surplus problem. That looks like a big contract, but it may be simpler than we think. Surely the regulation of milk flow to seasonal demands is to the extent it can be accomplished wholly in the hands of the producers. The producers themselves should, in my judgment, own and control the facilities for handling and the processes for marketing the milk and milk products that are now turned over to the contractor at a less price because he cannot or will not sell them as whole milk. Detailed discussion of this problem is not pertinent here, but I venture the hope that the size of the problem will not scare the producers, for they are the ones to solve it, and as they are now the sufferers under it they will be the beneficiaries in its solution.

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THE SIGNIFICANCE OF A KERNEL OF CORN.

GEORGE M. TWITCHELL.

From the Sixty-fifth Annual Report of the Massachusetts State Board of Agriculture.

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THE SIGNIFICANCE OF A KERNEL OF CORN.

GEORGE M. TWITCHELL, AUBURN, MAINE.

Because of war with all its terrors, the destruction of material property as well as life, the transfer of 40,000,000 men from the producing to the consuming class, the horror of devastation of cities, towns, estates, and homes, and the necessities of untold thousands of dependents, old and young, a new cry has arisen, and slowly we are coming to realize the necessity of conserving, that life in the future may be possible.

Through the liberality of nature pouring out so lavishly in rich harvests all over the world, year after year, men grew neglectful of that economy which alone can make for true comfort, prosperity and success. Waste, waste, waste on every hand has been the rule of the American people, increasing yearly. Whether on the farm or in town, the paths of present satisfaction and ease have been sought, the value of time seemingly neglected, and the necessity of utilization of the best there is in the individual not thought necessary.

If this demand for conservation comes home to the individual worker with sufficient force to insure deliberate, intelligent action it will prove one of the greatest blessings resulting from this terrible struggle, leading to the plainer, simple life, the utilization of home-grown products and agents now neglected, the growing of the food of support for the family, and the more critical study of all individual expenditures.

No class is to be more profoundly affected by these changing conditions than the farmer. Forced through shortage of labor and labor complications to get back to one-man farming, the crops to be grown must be those best adapted to the individual farm, and most valuable in supplying the food of support for the family. Whether in selection and preparation of the land, breeding and care of animals, or this great field of study and investigation in seed, the heavier the pressure

realized by individuals the greater will be the compensation. Here is the work for men, not possible to be performed by others, where every man must be a law unto himself.

The lavish appropriations by the national government and various boards and commissions for the uplift of farmers have been educating a generation of leaners. If this war disturbs this and forces the necessity, as well as the opportunity, for individual thinking, the outcome will be a wave of agricultural prosperity this nation has never known. Trained the worker must be, educated the thinker must become, but when once the fundamentals are fixed, theory must surrender to practice and experience become the teacher, which alone can save. In the wise economy of nature it has been ordained that he who does the best he knows obtains results commensurate with labor of hand and brain. There is no single path save that of principles. Practice must ever diverge though results converge. With this thought let us discuss flint corn.

If good results have attended your efforts along a path widely divergent from that here indicated, follow that path, for results alone must determine your line of action. The one essential to urge to-day is more corn on every farm. It is one of the stern realities growing out of the war. If the yield has been satisfactory to the grower in the past, we must realize to-day that it has not reached the limit of the farm, and strike for more corn per acre. The limit is the man, not the land.

Experience forces the conviction that deeper plowing, more careful plowing, the laying of the furrows at an even angle in breaking the sod, are all necessary for that uniform preparation of the land without which maximum crops are impossible. Some popular labor-saving machines gloss the surface of the field, but do not tear up the depths of the furrows. Force necessary to push feeding rootlets through hard soil can never be utilized for perfecting crops. Thorough preparation of the seed bed is a long stride towards record-breaking yield. It is not the cost of preparation, but the value of the possible crop which must determine action; hence we must consider well the initial steps.

For one, I like to plow in the fall, turning in the barn manure, and then cross plow in the early spring to break up

all particles and insure distribution of food all through the mass. Turning old sod in August and harrowing, as witch grass starts, then cross plowing early in the spring and preparing the land thoroughly, has completely killed this so-called pest and insured a good crop. Witch grass is one of the best friends a farmer can have, provided it stirs him to keep it in subjection, because in doing this the land gets better preparation for future work. The day has passed for "I guess that will do." Hereafter we must know of the thoroughness of every step, that we may find the minimum cost of production.

Maximum crops are insured only when grown on healthy soils. Healthy soils are dependent on living organisms made possible by cover crops, barn-yard manure and short-term rotation. Fifty years ago Pasteur, the great French biologist, proved the fact of life in the soil, yet to-day we have hardly grasped the significance of the lesson. The nitrification of organic nitrogen by these friendly forms of bacteria plays an important part in profitable crop production. Barn manure must again become the sheet anchor with every would-be successful cropper. The earlier that recognition of this fact forces increase of cattle, sheep and hogs on the farms the better for Massachusetts farmers and farming.

The future for New England agriculture hinges on increase of live stock. The intimate connection between the corn crib and tieup, sheepfold, hog ranch or poultry yard must be established. More corn opens the door and more live stock solves the problem which from any other standpoint is beyond human solution, save with a few specialists. The absolute impossibility of obtaining chemicals or mixed fertilizers balanced for the work required compels attention to the problem here presented, even if the high prices certain to be realized for meat products did not present attractions.

The best life of the State requires that its food of support be supplied in larger measure from its own farms. Dependence by farmers on outside markets for beef, lamb, pork and horses has largely killed that self-reliant spirit necessary for full protection of individual rights. When the time comes that the people of a State or Nation fail to grow the food of support, mental, moral and physical deterioration is invited. We grow only under pressure.

The vitality, uniformity and reproductive power of seed next claim attention, and will demand detailed consideration later. Frequent light cultivation can never be too strongly emphasized. I am forced to the conviction that after corn or potatoes are 6 inches high all cultivation should be confined to the upper 2 inches. By the time the corn is 8 inches tall the feeding rootlets meet between the rows. All food is taken in at the extremities of these rootlets, never by the main trunk roots. Weeds can have no place in the economy of good farming.

No man can afford to pay for, or produce, plant food to feed weeds in his corn field. A 1-inch dust mulch will save the corn crop on any New England farm. Count out the slackers on the farms and let them be known as leaners on the body of workers. There is no place in the present-day vocabularies for "I guess so" or "It can't be done." Only those ready to say "I can" and "I will" are wanted in the ranks of workers this year.

Maximum crops alone pay a profit, and for these to be possible the law of conservation must be religiously applied and enforced. This is 1918, and the conditions and demands of the present must dominate with every man. The cry of humanity as well as the necessities of war will force the issue on every corn field as well as every battlefield, and you and I must prepare to do our best, not through extended operations, but intensive, thinking of the greatest possible output per acre.

Of all farm crops produced on New England soil, flint corn stands at the head as the safest, surest, sanest, and, where rightly grown, most profitable. Found by our forefathers when they landed on Massachusetts soil, grown by the Indians for centuries before that period, it has claims upon our thought to-day, not to be disputed or disregarded. It is the one crop to be increased wherever possible for the good of the farm, the possible increase of live stock and the saving of the nation.

For three years farmers have been meeting adverse climatic conditions. Whether, in the cycle of the years, we are passing through a period of depression following the profligacy of nature we know not, but this is certain, that all preparations

for 1918 must be made to conserve to the utmost and help insure a maximum crop. In this, adaptability of crop to soil and locality becomes of prime importance. We cannot afford to take chances this season. Realizing this, the study of the kernel of corn becomes vital to every grower. After many years' experience in breeding flint corn, I am convinced that no other crop is so susceptible to environment or yields so readily to a cordial invitation, and at the same time that no crop will revert so rapidly when the directing hand of the master is lifted.

Maximum yield is still an unknown quantity, though a rapidly increasing number in every State has passed a level thought practically impossible a few years ago. While the average acre production of the State covers about 40 bushels of shelled corn, men in every locality are getting 100 or more. To lift the lower line, not drag down the upper, is the field for the careful worker to-day. That much attaches to soil selection, preparation and care, as well as fertilizing, is readily admitted; that more centers in seed growing and selection is not yet recognized. Far too many still persist in selecting seed from the crib, thereby checking the possibility of uniformity in yield, time of maturity or value of product. Some system of seed selection must be followed if increase in crop yield is desired and seed potency made certain.

Starting years ago with two ears from growers at the extremes of Maine, the work of seed selection has been critically followed, especial attention being paid to the kernel. Thinking only of the growth of stalk, size and abundance of leaves, location of the ear, number and size, width, depth, breadth and fullness of kernels, all thought of fancy points, such as well-filled tips, has been discarded. Practical utility has been the one purpose, and number of kernels per ear of greatest significance.

No man can continue to select seed with special reference to tip without ultimately reducing the length of the ear. Brought to New England by instructors from the dent corn regions it has been pressed as an essential to work injury where adopted. Every ear husked with one-half inch of cob protruding beyond the kernels is to me a warning that it was

ready to do its part, and that I failed somewhere to grasp the lesson to do my full duty.

Shelling out a lot of ears of varying length, 8 to 11 inches, it was a matter of no little surprise that there was less than one-fourth ounce difference in weight of the individual cobs, the 8, 9, 10 and $10\frac{1}{4}$ inch cobs weighing 1 ounce each, and the 11-inch, $1\frac{1}{4}$ ounces. This was crib-dried corn. An 8-inch ear should shell 8 ounces of corn, and for any increase in length we should get 1 ounce net for each inch. This is for 8-rowed corn, though in shelling out a lot of 12-rowed, I found no variation from this rule, the net weights being the same. An 8-inch ear of 8-rowed corn should yield 380 full kernels, and for every inch increase in length 48 kernels should be added. If we are not getting this something is wrong with our work.

Here we touch the significance of the kernel, for the increase of 1 inch to the ears would signify an increase of practically 8 bushels per acre. Years ago I set my standard at one ear on every stalk and 500 kernels on every ear, and while that may never be reached, except in isolated cases, it is still the objective point, and some progress is yearly being made. Kernel by kernel, length of ear is slowly yielding to an insistent demand for more, while width, depth and thickness of kernel seem well established.

You of southern Massachusetts should set your standard higher, for the Maine crop must be matured in one hundred days or less, and we cannot grow as large ears as you.

No man can be content with present attainment without absolute loss in the future. That man who has struck twelve in production of any crop will hardly reach that level again. It is the everlasting reaching out after such control as will command more that alone may insure additional length of cob and number of kernels.

To plant 1 acre, the rows 3 feet apart, 5 kernels every 36 inches, will require practically 18,000 kernels. As a rule, seed testing 95 to 97 in the box loses 15 to 20 per cent in field germination, and about 14,500 stalks will be found on an acre of good corn. Observation in many fields, covering a number of years, indicates that of these 14,500 stalks 20 to 25 per

cent will be barren, leaving practically 11,000 bearing stalks. Here is a loss in seed and production not to be overlooked. It has to do with the kernel, and is in too many cases the pivotal point between success and failure. To put more vitality and virility into our seed must first be the objective point with the grower.

Better preparation of the land, more frequent light cultivation, and the destruction of all weeds are essentials. Before the last going over with the cultivator apply between the rows 200 pounds of fertilizer carrying 3 to 3½ per cent of nitrogen, 6 per cent of phosphoric acid, and, if possible, as much potash, all in form to be promptly available. As this will be applied just before the corn spindles, it will hasten growth of leaf and stalk and carry the crop through to full maturity, increasing length of ears and crop and yield of shelled corn. Looking for seed, the possibility of fertilization of silks by pollen from non-productive stalks must be checked through detasseling or cutting out all barren stalks as soon as spindles are well developed. If this forces the planting of a special breeding plot, away from the field, where the ear-to-row system may be followed, increase in quantity grown and higher seed potency may be expected, with strong probability of increased protein value. As everything must here tend to perfection of seed it will pay to remove all suckers on this plot, as well as non-bearing stalks, and thin to three stalks to the hill, allowing abundance of sunlight.

Dent corn averages 9.50 per cent protein; our New England flint corn, 10 to 10.50, while analysis of a number of ears from my breeding plot in 1909 ran as high as 12.65 per cent. Here is the elusive element in corn, to be diligently sought after through breeding, selection and feeding, and has to do entirely with the kernel.

No one step leads so directly to improvement and increase in kernels as the ear-to-row breeding plot, whereby planting one ear to a row, or a given number of kernels from selected ears, it is only necessary to keep record of the length of the parent ear for each row planted, and the number of kernels thereon, to know of the progress made. There is not a variety of flint corn but can, by judicious selection and careful

treatment, be radically changed in length of ear, number and shape of kernels and size and shape of cob, as well as number of days required for maturity.

Longfellow flint corn is a long, tapering, 8-rowed variety from northern New York, yet a New Hampshire man, getting seed from Mr. Longfellow direct, found in his crop that season one ear of 12-rowed. This was planted by itself, and in five years not an 8-rowed ear could be found. Selection will modify or change any characteristics. We want to believe this, and then go to work and add more kernels to the variety we now have. To accomplish this there must be some system of marking the more vigorous hills or stalks early in the season if seed is taken from the field, and then following them until ready to break.

No ear should be saved unless the stalk is large at the ground, tapering to the spindle, at least 8 feet tall, and carrying an abundance of large, long leaves and at least one good ear set close to the stalk, never out on an arm. When husks are dry one-third down, go through and break out the best ears, later discarding all not uniform in shape and size and of desired length. I like to hang these choice ears by themselves in a shady place where there is plenty of air, or, if traced, to put only five or six ears in a trace to hang until thoroughly dried. From every angle the selfsame lesson is presented the thinking grower. The power of blood in corn may easily be seen in the prepotency of that old variety known as King Philip. Generations after breaking with this once so popular variety, the red cob and kernel, and peculiar shape of the old favorite, will be met. So, also, with Canada early, though not in as marked degree.

If ever there is increase in yield, shape or size of kernel it will be through the organizing power of the human brain, — yours and mine. The great incentive for progress is a big conception of what a man can do and the determination to excel all past achievements. We want a clearer corn vision, that there may follow greater enthusiasm for its realization. Having this in common, but a few years would be necessary to lift the corn production of the State to 80 bushels of shelled corn per acre, — twice what it is to-day.

The whole problem rests with the man and his servant, the kernel of corn. Not a step is required here but what is demanded by good farming. To obtain this you cannot go far from home for seed. Better take what you have and build on that than risk seed grown under different environment. Last year a few ears of corn were sent me by a Pennsylvania house as extra Early Northern. The ears were large, too large for our climate, but it was put into the hands of a careful grower, on good corn land, with room to test carefully. The result was a 12-foot stalk, ears 6 feet from the ground, and immature when the frost came in October. The danger element is so great when ordering seed from a distance that I would emphasize the greater security through home-grown. More than this, what a man does out of his own energies gives enthusiasm for further efforts, and this insures increase and better farming. Grow your own seed corn.

If the law of the State prohibited the purchase of seed outside, and required every man to produce his own under a rigid system of selection, it would insure better crops everywhere, through closer attention to simple details. That personal interests, financial interests, do not necessitate this is one of the facts past comprehension.

For improvement in corn, seed environment must be made congenial, soil adaptability appreciated, and selection made from largest and best ears, carrying kernels of the right type. No man can follow this conscientiously, year after year, without steadily increasing the value and yield per acre. It is the law of progress applied to the homely duties of the farm.

The set of the ear on the stalk bears important relation to the length of days necessary for maturity. If you want an eighty-day corn, select ears which come out near the ground, though by so doing you reduce length of ear and yield. Looking for a crop to mature, ready for seed breaking, in one hundred days, and to yield 100 bushels of shelled corn I select ears about 2½ feet from the ground. The danger in selecting from the bin is that of getting a wide variation in time necessary for growth. The risk in buying is that you have and can have no knowledge of conditions or rules governing selection. Success in this world is made up of a bundle of seeming trifles,

each contributing to the sum total aimed at, not one to be neglected without certain loss.

In selecting yellow-eyed beans for seed next year, from the field before pulling, I found stalks carrying but 5 well-filled pods, others 50, and one 94, and 50 was made the minimum. It required a little time to go over the field and do this, but it must pay in increased yield if systematically followed for a few years. An old farmer in Maine built up a remarkable strain of oats by selection from the field, discarding all stools not carrying 13 or more stalks, with large heads and well-shaped kernels.

Hill selection of potatoes has radically improved production under normal crop conditions, but only through unit breeding do we approach uniformity in type or yield. Everywhere it is the same, the law of breeding applied in the field, as it must be in the tieup or sheepfold. Good crops are grown to-day, but those will not suffice to-morrow. Every condition facing the grower of 1918 forces consideration of any and all problems promising to insure increase of yield and higher potency in reproduction, as well as value of product.

It is not alone a question of what we would have; every economic viewpoint forces what we must do if we are to aid in conserving life or energies. Here in the corn field you and I may do our bit, but we cannot do it well unless through careful study of the kernel, we seek for that increase and improvement possible.

In Wisconsin, in five years' time, a decided increase in size, shape of ear and yield per acre was obtained by a simple system of seed selection. The variation in yield between ears of corn of the same size and variety is so great as to demand of the grower such comparative tests as will tend to greater uniformity. Ears of the same number of kernels from the same field will vary so widely as to surprise any one who makes the simple test. No man can afford to use seed from the bin, or that saved at husking time; only the ear-to-row test will establish the grower. After several years' hill selection of potatoes, discarding all which failed to give 7 to 9 of merchantable size, and a minimum number of small ones, my first test in unit breeding, using seed from the hill-selected stock

of the same variety and weight, gave a variation in yield from $6\frac{1}{2}$ to $16\frac{3}{4}$ pounds per potato.

Later years have reduced this variation, thereby proving the possibility as well as the profit of this simple line of work. There must be some system of seed growing and selection by which we can approach uniformity in production and reproductive powers, and for this we must diligently seek. In the animal kingdom it rests with the individual, not the herd or flock; in the vegetable, fruit or grain fields the same law holds, and it is up to us to work out the system ourselves. It cannot be done for us by another. What per cent of seed ears do you get per acre? Careful records prove a range of 5 to 60 and he who approaches the higher must realize increase in yield of 50 to 100 per cent, the whole problem revolving about the kernels.

We are tenants of the soil, not absolute owners; to be judged by what we produce, how we produce it and in what condition we leave the land for others. No man can be a farm slacker to-day and merit recognition. To waste energies or material is criminal; to conserve is manly.

Find your system where you will, but let it be the best you can grasp, and then follow it religiously, and years will bring added increase in quantity and quality of crop produced. Real helpfulness from an institution or individual comes not through following blindly the path others have traveled, but in the awakened resolve to make a straight path for yourself. The only enduring help is self help. If I am able to set in motion forces, and bring to men the consciousness that the finest and best help comes from within, the full purpose of this hour will be realized.

Theodore Roosevelt never gave utterance to a truer statement than, after coming out of the jungle, in an address before a Chinese college, he said, "Beware of that man who fails to translate his words into deeds."

Measured by that standard, where do you and I stand to-day? Are we adding to the sum total of knowledge? Are we demonstrating, through actual experience, the straight path to higher service? Are we yearly getting control of the factors centering in the kernel of corn for our own profit and the good

of others, or are we camp followers leaving to coming generations that pioneer work which alone can save? You and I have each 400,000,000 brain cells, and there is no full, free manhood until every cell is developed. Where do we stand in the list? These God-given powers are not for selfish use, but to increase for the enrichment of the world, the moving back of the wall of the centuries, the bringing in of the glory of the man that sometime is to be. Are we translating these simple corn lessons in our yearly experiences for our own enrichment and the blessing of the world, or are we going to the store or to our neighbor's cribs, not knowing whether seed is adapted to our environment or not? Are you standing straight in your field or are you a leaner? It is time for us to translate the little everyday experiences of farm life into big problems of actual service and divine potentiality.

There is an old saying that "An honest man is the noblest work of God," but there seems to be varying definitions of honesty. There is as loud a call for this attribute in the corn field as in trade. No man can cheat nature and be true to himself. In the warp and woof of life every false thread weakens the fabric, and God, through nature, is exacting of us a full equivalent. You and I need to wake to a larger appreciation of our obligations, certain that by so doing the kernels will increase and the sum total of human comfort be greatly augmented.

If there is a cry for more wheat in the west, more cotton in the south, more potatoes, sheep, cattle, hogs everywhere, we may hear the call for more corn in New England. Listen, brother farmers, to the cry going up to-day from ruined countries and starving Europe, as well as hungry America, and prepare to do this year better service, to grow more corn per acre, than ever before, that burdens now bearing so heavily may be lifted. Profoundly am I convinced of the increased value of the corn crop and necessity for finding that on every farm. We face a year when one-man farming must govern because of inability to get competent help or pay the wages men obtain in certain other lines of work. No farmer can find justification for paying wages demanded unless certain he can utilize the same to a profit. The hour has struck

when the earning capacity of a man must be critically measured. If this leads to restricted operations in the barn or field, without forcing its full lesson, we shall suffer. If it arouses men to grapple with the problem of maximum output at minimum cost it will prove one of the richest legacies of the century. To what degree can we reduce acreage and increase total volume of production? Can such a result be made possible? These are the questions forcing themselves upon the farmer to-day, not to be answered by another, but grappled with by the individual and proven in his own field of labor.

The possibilities of seed selection in increasing crop production are still an unknown quantity. The certainty that this opens the door to our financial salvation is not yet appreciated. Experience teaches that it is a simple proposition to double the average corn crop of the State, and for this I plead. Here is where every farmer can do his bit for his country. Upon the shoulders of the men on the farms of the United States rests the responsibility of feeding the allied armies of the world, and all dependents, as well as our own population. Not yet are we alive to the necessity for doing our best and our utmost. The cry ringing in the ears of every farmer to-day should be that old-time cry of Carlyle, "The best there is in you, and the whole of it." There is no sacrifice for us except to those who send dear ones to the front, but there is an opportunity for service for every man, which love of home and country, faith in American institutions and American standards, and hope for the future should inspire. It is the determination to be the best possible, to toil and plan, save and conserve at every step and in every way, that our institutions so dear, and that democracy of individual liberty, born on the rugged hills of this north land, may under God be preserved, and, through the united service of the boys at the front and the men and women at home, be transmitted to coming generations a priceless heritage.

I follow my convictions, wherever they may lead.
I cannot choose my duties, I cannot choose my creed.
And none can choose them for me, no church, or priest, or clan;
I follow my convictions, if I'm an honest man.

Oh, brother in the conflict, be earnest, brave and true.
Dare to be independent, and think your problems through.
Love God and love your neighbor, do all the good you can,
And follow your convictions, and be an honest man.

Mr. Maynard. Will the Doctor please state once more the number of kernels that ought to be on an 8-inch ear of corn? I wasn't quite quick enough to copy that.

Dr. Twitchell. I want 380 broad, deep, full kernels. Here is a difference in corn on the cob; we find it in so many cases, as I pointed out, — what we term the "chip." There is an open space there. I want to close that, and that is what I mean by broad, deep kernels, so there will be no space at all on the cob. As we break an ear I can't see any space; every kernel of it is close to the cob. That is where we get the maximum corn on the individual cob.

Mr. Maynard. How many kernels per inch, extra, above that?

Dr. Twitchell. Forty-eight.

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THE IMPORTANCE OF HONEY PRODUCTION.

E. R. ROOT.

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THE IMPORTANCE OF HONEY PRODUCTION.

E. R. ROOT, MEDINA, OHIO.

Last August I stood on the Brooklyn docks, New York, and saw 2,000 tons of honey — a whole shipload — going to Europe. Two thousand tons! It seems like a large amount. To the uninitiated it might look as if that were more than the production of the entire United States. As a matter of fact, this one shipload of honey was only one of several, how many, I do not know. It has been estimated that the entire annual production of honey in the United States is somewhere between 200,000,000 and 300,000,000 pounds,[1] or seventy-five times as much as what I saw on the docks representing one shipload. In dollars and cents the annual production of honey for the United States at present prices would amount to between $40,000,000 and $60,000,000.

There are several large factories engaged in the manufacture of beekeepers' supplies, one of which has an investment of over $1,000,000. There are thousands of beekeepers who are producing honey by the carload in the United States. These large producers are located mainly in the western States; California will produce 500 cars of honey, Colorado and Texas will produce nearly as much. While honey is produced largely in the eastern States, it is on account of the greater population consumed locally.

The question may be raised, "What is Europe doing with so much honey that she requires it in shipload quantities?" The answer is easy. Sugar is scarce. Where it can be bought at all it is bringing over there all the way from 60 to 70 cents, and even $1 a pound. The immense sugar beet fields of

[1] This, loaded on freight cars, would make one solid train 100 miles long.

Europe have been devoted to growing grain crops. Germany has practically no sugar; and her common people, at least, have to depend on saccharine, — something that has absolutely no food value, but, on the contrary, is regarded as a cumulative poison.

There is likewise a scarcity of sugar among the allies, notwithstanding that five times as much has been shipped from the United States and the West Indies to Europe as was shipped before the war.

The only other substitute for sugar that has any food value is honey. Not enough honey is produced to supply the shortage of sugar, either in the United States or in Europe. Unlike sugar, honey, up until recently, could be bought in any quantity provided one had the price. When the war started in, in 1914, prices on honey began to sag. The very finest liquid clover honey could be had in car lots at 5½ cents, and some of the southern grades were begging for customers at 1¾ and 2 cents a pound. To-day the best table extracted clover and alfalfa, and mountain sage, is bringing 20 cents in car lots, where it can be had at all, and there is a probability of its advancing higher before the next crop is ready. This means that the average farmer or back lot beekeeper owning a few bees can get in a retail way from 25 to 30 cents for extracted honey, and from 40 to 50 cents a pound for his comb honey. This is on the supposition that he knows the market and does not give his honey away at the old prices that prevailed during peace times.

There never was a time in the history of the world when there was a greater demand for sugar and honey than now. Except in limited localities the average farmer cannot grow the sugar beet; but every farmer can keep bees anywhere in the United States. It becomes, therefore, a patriotic duty on the part of every citizen, whether he owns a farm or whether he has a back lot where he can keep a few bees, to help make up for the sugar shortage by producing honey. No matter what we hear about the sugar shortage being relieved, it is as sure as fate that sugar will be scarce; for the vast quantities that are being shipped to Europe, where prices are higher than here, will make the commodity scarce in this country, and of course will create a strong demand for honey.

But there are other forms of sugar besides those found in the sugar cane and the nectaries of flowers from which the bees gather their sweets. The sugar in fruits is in the best form possible for direct assimilation. Like honey, fruit sugar is more easily digested than cane or beet sugar. It likewise

becomes a patriotic duty of every citizen of the United States, whether he is a farmer or a backlotter, to grow all the fruit he can, as well as honey.

At this point it is pertinent to ask how the beekeeper can make more and better fruit. I do not need to say to some of the farmers facing me to-day that it is necessary both to spray and prune the trees in order to get the maximum of fruit. It is necessary to spray to kill the coddling moth and the San José scale. It is necessary to prune and prune so that fruit may be grown instead of firewood. In other words, the energies of the tree should be concentrated on the fruit and not on the wood. But that is not all. The little honeybees, which I have the honor to represent to-day, perform a most important part in pollinating fruit blossoms in early spring. What do I mean by pollinating? I mean this: There are certain plants and trees that need cross-fertilization the same as some of our live stock. That simply means this: That the pollen of one blossom must by some means — wind, rain or insects — be conveyed to the blossoms of another variety. A perfect flower has male and female organs. Some flowers have only the male and others only the female organs; and in many and most cases where both sexes are represented in the same blossom, a better fruitage is secured when the pollen of several varieties are mingled together.

Professor F. A. Waugh, one of the greatest authorities on fruit growing in the United States, and a professor at your Agricultural College at Amherst, has repeatedly made the statement that but little pollination is effected by means of wind and rain; that most of it is effected by insects, mainly the honeybees. There are certain legumes — the clovers (white, red, peavine, alsike and sweet) — that cannot develop seed without the agency of the bees. Experiment stations have shown everywhere that when limbs or whole trees of certain varieties of fruit are covered with mosquito netting before coming into bloom, but very little fruit will mature. The experiment is more striking when a single limb of a tree is covered with mosquito netting. Where the variety is sterile to its own pollen, only about 2 per cent of fruit will mature on the covered limb, while the rest of the tree will have the normal amount.

As there are very few insects flying in early spring except the bees, it is clear that the bees do practically all the work.

As many farmers within the reach of my voice have buckwheat or some of the clovers, and as many others are growing some fruit, a few specific instances that have come under my observation may not come amiss at this time to show how bees make more seed and more and better fruit.

In the vicinity of Glassboro, New Jersey, there are something like 5,000 acres of apple, peach and pear orchards. The fruit growers in that vicinity have learned that it pays them to give a bonus to the local beekeepers at the rate of $5 a colony for putting bees in their orchards only during the time the trees are in bloom. Albert Repp (one of the most extensive growers in the vicinity) in the "Country Gentleman" about two years ago said: "I would no more think of trying to grow apples, peaches and pears without bees than I would think of trying to get along without spraying or pruning."

South of Boston, cranberries are grown in a large way. When the cultivated bogs were small it was observed that good yields of the berries could be secured; but when the acreage had been increased the crop kept getting smaller and smaller per acre. It was finally discovered that there were too few bees in the vicinity of these large bogs. When enough bees were put around the bogs, the yield of cranberries became normal again.

There is a 50-acre apple orchard about 10 miles north of my home in Medina, Ohio. For years this orchard was neglected, and yielded scarcely 500 bushels per year. It finally came into the possession of a practical fruit grower. He began spraying and pruning, and then he said he wanted me to put some bees on his place. I did so, furnishing one colony to the acre. What were the results? The first year he secured 16,000 bushels of apples, all of them perfect. The next year he secured 12,000 bushels. Owing to the help of the bees he had from 5,000 bushels during the poorest year up to 16,000 during the best.

At a large cherry orchard just east of Medina, we put some bees. The spring of 1917 was quite chilly and backward. There was only an hour or two when the bees could fly during

the blooming period. The result was that during the summer only those trees that were in the immediate vicinity of the hives yielded a good crop; and those trees directly over the hives had the best yield. It had been so cold that the bees could fly only short distances in blooming time; from this it is very evident that the trees that the bees could reach were the only ones that had any fruit of any consequence.

In one of my western trips I learned that there was in the Pejario valley, near San José, a 15,000-acre apple orchard where it was said there were no bees, and no bees needed. This was news to me. I made an investigation and found bees in the vicinity, but probably not enough to pollinate the entire 15,000 acres. I called on the horticulturist, and asked him why he did not have more bees. His answer was somewhat significant. He said: "Mr. Root, the two varieties of apples we grow here are the Downing and the Belleflower. They are fertile to their own pollen and therefore we do not need any bees." Then he added: "If we were to put bees in the locality the trees would be broken down by the weight of the fruit. We have to hand-pick as it is, because so many apples start. If we put bees here, there would be too many apples."

Most of the varieties of apples, at least some of the finer ones, are either partially sterile to their own pollen or are entirely so. Where this occurs bees are needed to fertilize the blossoms. The result is that the fruit growers all over the United States are asking for bees. In many cases they are willing to pay a bonus to get the bees in their orchards. Bees are being shipped every spring from the southern States to the northern orchards to pollinate the fruit trees. Sometimes they come in car lots, and at other times they are sent in packages of 1, 2 and 3 pounds by express.

What is true of the northern fruit orchards is true to a lesser extent with the citrus orchards of the southland. Fewer bees are needed in an orange grove because the weather is warm and the period of blooming longer. In the northern orchards the work of pollinization must be done in a few hours, or at most in two or three days, hence more bees are required per acre.

Some twenty-five years ago I gave an address before the

American Pomological Society, Buffalo, on the subject of "Bees as Marriage Priests," and I then could plainly see that there was some opposition to the bees on the part of the fruit growers. To-day one can scarcely find an up-to-date grower who does not welcome bees — the more the better.

Coming back, then, to our original proposition of growing more sweets or more sugar it is plain to be seen that if bees produce something like $50,000,000 worth of honey every year in the United States, they are actually contributing to the wealth of the country by making more and better fruit to the extent of possibly $100,000,000 worth. Taking it all in all, the little bee is no small factor in contributing to the wealth of the country, and, what is more, helping us to win this war.

Perhaps it may be said, "Why all this furore about sugar?" The facts are, sugar is just as necessary for a balanced ration in the human family as meat, eggs, wheat, or any of the staple grains. Sugar is an energy producer. In our great cities the poor people are suffering for the want of sugar. They have a distinct craving for it. That is the reason why our soldier boys from the trenches are willing to pay at the canteens in France $1.10 a pound for honey. Certainly nothing is more exhausting than trench work, and therefore it becomes the bounden duty — yes, the patriotic duty — of every citizen of the United States to help feed not only the soldiers but a hungry world by supplying one of the necessary food elements — sugar — in the form of honey or fruit juices. If you have ever deprived yourself for just thirty days of sugar, in all forms, such as cake, pies, pastry, candy, etc., you will find that you have a ravenous appetite for it. There is no doubt that in ordinary times we eat too much candy; but during this period of war we cannot get too much sugar in the form of honey or fruit.

Now I am coming down to the vital question: Ought the farmer or backlotter to keep bees, and, if so, can he? Most emphatically I say yes to both questions. Nay, more, — it is his patriotic duty. It is just as easy to keep a few hives of bees as it is to keep a few chickens. What one farmer has done, others can do. If there is going to be a shortage of sugar this year and next, then it is up to the beekeeper and

his family to raise their own sugar by keeping bees. Honey can be used in almost any way that sugar can. It can be used for sweetening coffee and tea, for canning fruit, for making cakes, and for making candy. Indeed, one of the large baking companies, I have been told, has been buying honey by the hundred-car lots. These concerns have discovered that a little honey used in connection with sugar makes a cake keep soft and moist. Without honey or invert sugar, they will become dry and unsalable. It is safe to say that practically all of the cakes and cookies in the groceries and in the bakeshops contain a little honey.

Now, then, if honey can be used in place of sugar, can the problem of swarming be handled by the farmer? Yes. There are textbooks now that show how this can be done. In your own State of Massachusetts, at the Agricultural College at Amherst, you have for teaching beekeeping one of the best schools on the entire continent. Indeed, Massachusetts leads off and stands in the very forefront in the instruction it is giving on bees. Any farmer's boy or daughter can take the course at the college.

The average colony of bees will cost somewhere about $5. At the present prices of honey to-day, that colony, if a normal crop be secured, can bring back in value between 400 and 500 per cent. Indeed, I believe I am safe in saying there is nothing on the farm, for the money invested, not even the hog business, and that is going some, that will yield larger returns. When a $5 investment in a fair year can bring back to its owner as much as $25, show me something on the farm or back lot that will do better. The chicken business cannot do it, because the price of feed is nearly up to the price of the eggs. I have been told that a number are going out of the poultry business because the price of feed is so high. But in a fair season the bees find their own food, and then turn around and give the owner the surplus.

I do not wish to imply that there are no losses or failures with bees. Some winters they die; some seasons they have to be fed to keep them from starving. Some years they will not produce any surplus honey. But is there anything on the farm that does not fail some seasons?

To recapitulate: We can produce sugar on our farms and in our town and city back lots by keeping bees. We are advised by the United States Food Administration to keep a pig to help a starving world. It may look as if I were prompted by selfish motives when I say that the same money invested in bees will actually go further. A pig pen in a town is often and generally unsanitary. It is a breeder of flies and disease. A few hives of bees in every back lot and every farm are not only not objectionable from a sanitary point of view, but will actually save millions of dollars in sweets that are now going to waste in the fields because there are no bees to gather them. Dr. E. F. Phillips, bee expert in the Department of Agriculture, Washington, District of Columbia, says that at least ten times as much honey could be secured, where there are no bees, as there is now. In most localities there are few or no bees. It is our duty to supply sweets, and honey and fruit sugars are the most wholesome of them all.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

CIRCULAR No. 82.

January, 1918.

THE RELATION OF THE RAILROAD TO THE FARMER.

GEORGE A. CULLEN.

FROM THE SIXTY-FIFTH ANNUAL REPORT OF THE MASSACHUSETTS STATE BOARD OF AGRICULTURE.

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THE RELATION OF THE RAILROAD TO THE FARMER.

GEORGE A. CULLEN, PASSENGER TRAFFIC MANAGER OF THE DELAWARE, LACKAWANNA & WESTERN RAILROAD COMPANY.

The subject upon which your Board has honored me with an invitation to speak, "The Relation of the Railroad to the Farmer," is one involving such nation-wide interests, is so related to the history of the progress and development of our whole industrial and social life, and is so charged with suggestiveness of possibilities for the future, that it is with a very real hesitancy that I undertake to speak at all upon it to an audience so well informed as this, and especially, in the cursory and sketchy way that is necessary in the limitations imposed by an occasion like this.

There is an obvious fitness in linking the farmer and the railroad. They represent, in the order named, the two interests which stand at the head of the industrial life of our people, and comprise between them nearly 30 per cent of the total national wealth, the estimated value of the farms and farm property at the present time being approximately $50,000,000,000, and of the railroads almost $20,000,000,000.

But it is not alone, or chiefly, as the two most important of our industries that the two components of our subject find their relationship, but rather in the interdependence of their very existence under the conditions which have made, and, let us hope, are still to keep, our nation the greatest mankind has known.

If your Board had phrased this subject, "The Relation of the Farmer to the Railroad," instead of "The Relation of the Railroad to the Farmer," you would naturally expect the emphasis to be laid upon what the farmer has done for (or perhaps what he should do to) the railroad, but styled as it

is, I assume it is expected that I shall deal with it subjectively for the railroad and objectively for the farmer.

It is quite possible that our people with their natural force of character would, in the past eighty years, have made substantial progress in settling and developing the more accessible and fertile sections of our country, even without a railroad system much more extensive than that of Russia, which has one-sixth of our mileage with nearly twice our population. But who thinks that anything approaching the present magnificent development could have taken place without the pioneer daring, the masterly constructiveness and the organizing genius which have given us a network of railways of a quarter of a million miles, six times as extensive as that of Germany, eight times as great as that of France, eleven times as great as that of Great Britain, and comprising over one-third of the entire railroad mileage of the world.

But it is not my purpose to dwell upon what the railroads have done for the country as a whole, how they have so developed their efficiency that to-day they transport freight at an average rate per ton mile of little more than half that of Germany, France or Austria, while paying wages twice as great. Nor of how, for corresponding accommodations, they carry passengers at an average of $33\frac{1}{3}$ per cent lower fares than do the railroads of Europe. Nor yet of how the preferences and discriminations of European railroads are practically unknown here. My object is rather to outline for you the attitude of the railroad to the farmer, and the interest the railroad has in the prosperity and development of the farms of the nation.

Let us recall for the moment, if you please, the extraordinary history of the past eighty years since railroads have been a factor in our life, as compared with the previous two hundred years of our existence on this continent and of fifty as a nation. In 1835 the population of the country was 15,000,000, and the total population of the only two States west of the Mississippi River then existing (Missouri and Louisiana) was about half that of the present city of St. Louis. To-day the total population of the country has grown sevenfold, while that of the territory west of the Mississippi River is twice as great as was that of the entire United States in 1835.

It is more than a coincidence that this remarkable growth of population in this country parallels so closely the development of the railroads. Railroads were inaugurated at about the same time in all the civilized countries of the world, and in none of the others has there been anything to compare with the situation I have just described, except subsequently in Canada, Brazil and the Argentine, where America's already successful experiment was copied. Now, the reason for the difference is not hard to find. In America alone, broadly speaking, was the policy adopted from the start of pushing the railroads out ahead of the population, not only into the far and middle west, but also into unsettled sections of the east. In all these cases the railroad projectors built upon hope, and with a vision and a financial courage unequaled probably in all the history of mankind.

Coupled with the marvelous achievements in securing the capital, solving the engineering problems and marshaling and directing the forces of men and material, there was another phase of this pioneer work that some of us not yet in middle life can well remember as boys, especially if, as in the case of the speaker, we lived in one of those gateways through which its visible manifestations marched in an unbroken procession to people the new promised lands flowing with possibilities of great harvests of grain and vegetables and cattle, to say nothing of blizzards, cyclones and grasshoppers. I refer, of course, to the gigantic colonization agencies of the Union Pacific, the Burlington, the Santa Fé, the Rock Island, the Missouri Pacific, the Northern Pacific and other great systems of the west, which, not content with posting quarter sheet cards on every telegraph pole, fence and barn in staid New England, sent its emissaries by the thousands across the sea, and there preached the gospel of prosperity and happiness in the land of freedom to the daring or the disappointed of Europe. We know how whole States, such as Kansas, Nebraska, Minnesota and the Dakotas, were peopled in this way.

We often forget, however, that the government did not do this, and that the people of the United States as a whole did not do it, but that we owe this, which has probably been one of the most important factors in our present national great-

ness, almost, if not quite wholly, to our railroads. But let us pass over all these evidences of how the railroads have regarded the farmers in our past and turn to the situation as it is to-day.

Because the country is now considered to be "settled up" — which, of course, it is not, only sprinkled with population in a large part of its arable area — it is sometimes thought the interest of the railroad in furthering the development of the farm has subsided if not died out.

Is this the case? The conditions show it to be unlikely and the practices of the railroads show it to be untrue.

In the first place, the railroads of the country at large derive 15 per cent of their entire freight traffic (in tonnage) from the products of the farm, including animals, varying geographically from 10 per cent in the far east to 25 per cent in the far west. In addition to this, it is roughly estimated that, the country over, 25 per cent of all the passenger traffic consists of farmers and their families and employees. Very good reasons of self-interest, these, why the railroads desire to see the farmer successful. Then, again, the successful farmer produces a very appreciable inbound freight traffic, in the matter of building material, household goods, clothing, agricultural implements, fertilizers, coal, etc., which yields a considerable revenue to the roads, and which, obviously, is in direct ratio to the farmer's prosperity. Further, the growth of cities and towns is directly dependent, to a large degree, upon the development of the agricultural sections in which they are located, and the traffic of those towns is all grist to the railroad mill. Another element it is well to consider, though we hear little of it in this connection, is that the railroad is a large employer of labor, this item comprising over 60 per cent of the cost of operation, and involving the services of nearly 2,000,000 men, who, with their dependents, represent a population of at least 8,000,000 persons. Now, the primary element in the wages of employees (as we have seen so clearly in the past few years) is the cost of living, and the principal item in the cost of living is the price of food. Hence the railroad is very directly interested in the production of a sufficient food supply, so that wages may not be forced to a point, as threatens now, where

the roads cannot be operated except at a loss, or with a very meager return to those who have supplied the capital.

With all these incentives it is no wonder that the progressive railroad systems of the day endeavor not only to provide, through either their freight or express or special service, adequate transportation facilities to enable the farmer to get his products to market under the most favorable conditions, but also (and this is the principal subject of my talk) to give him such assistance, advice and service in connection with the production of his output as the highly organized character of the railroad business frequently makes practicable and easy where it would be difficult, if not impossible, for individual farmers or groups of farmers acting for themselves.

Under the head of transportation of farm products, let us say a word in passing. You know, of course, that in the transportation of grain, hay, tobacco, cotton, potatoes and most of the staple vegetables the regulation type of box car is used, which with certain modifications for the different classes of products satisfactorily answers the purpose. The railroads, however, recognize that there are products that cannot be transported in the farmer's interests nor in their own or those of the general public by this means, and a great many millions of dollars are invested in cars specially constructed for carrying such products as milk, poultry, horses and highly perishable fruits and vegetables. Moreover, where perishables are produced in sufficient quantities to warrant it, special fast service is provided, such as the well-known transcontinental citrus fruit trains, the peach, watermelon and small-fruit trains between the southern farms and the northern markets, and the fast milk service which is performed in connection with all of our larger cities. The company of which I have the honor of being an officer, the Lackawanna Railroad, brings into New York City every night 60 cars of milk in three trains operated on limited passenger train schedules from central New York, a distance of 250 miles. When you realize that this meant in the past year 126,000,000 quarts of milk, and know, as you do, that one cow produces on an average of 2,500 quarts per year, you can see how this company is, on the one hand, aiding some 50,000 cows to do their daily duty, and, on the

other, keeping 400,000 babies alive, that is, assuming all the milk goes to the babies, and not to some such anti-Hoover purpose as making ice cream, soda water or milk punches. Instances could be multiplied of special service somewhat similar to this all over the country, but time presses and I pass to the main subject.

The activities of the different railroads in contributing to the agricultural development of the territory served by their lines vary, not only with the different sections and localities and with the character of the products raised, but also in a marked degree with the individual judgments, opinions or preferences of the different railroad managements concerned. This is but natural when you realize that the work is done by railroad men who do not claim to be farmers, but who are obliged to select from the many plans put forth by agricultural experts those best suited to their conditions and to the degree of effort, personal and financial, they feel they can profitably expend upon it.

Certain railroads, such notably as the New York Central, have made extensive investments in demonstration and experimental farms located in the center of potentially rich agricultural regions where it has been found that the farmers have not availed themselves in a marked degree of the gradually improved methods developed under the scientific and practical direction of the United States and the State departments of agriculture. These demonstration farms have undoubtedly proven of great benefit to the farmers in their immediate vicinity, and have gone far to inculcate a knowledge of better methods of draining, seeding, spraying, cultivating and other features.

Other roads (comprising quite a large proportion of those of the country) have made a very important contribution to the general good by operating at frequent intervals trains specially fitted up for the purpose, and accompanied by agricultural experts who give at rural stations all along the line lectures and demonstrations upon a great variety of subjects, such as seed selection, cow testing, land clearing, liming, treatment of live stock for diseases, the introduction of alfalfa, soy beans, etc., and the use of farm machinery, including the newly de-

veloped and highly efficient tractors which are now used to great advantage, both for plowing and harvesting, on the small farms as well as on the large. Figures are not available showing the number of miles covered by trains of this character throughout the country, but they must run into the hundreds of thousands a year, and testimony is abundant as to the benefits derived.

The principle involved is the same as in that of the demonstration farm, namely, that the actual exhibition of the process involved stamps upon the mind a more lasting impression than any amount of reading of bulletins or agricultural papers can do.

Several of the western railroads and a few in the east have made a practice for several years of keeping in constant employment a corps of agricultural experts who devote their entire time to visiting the individual farmers along their lines, getting well acquainted with them, and, by personal contact, inducing them to experiment on their own land with new scientific methods, in that way adding to visual demonstration the important element of personal persuasion, which often is a most important factor, as we all know, in any line of endeavor.

Most of the methods in question are more or less familiar to all of you, and I will not stop to dwell upon them in the general terms that would be necessary, but with your permission will proceed to give you something more at first hand in describing the activities of our own company, with which I have been identified from the start, in the development of agriculture in the region reached by its line, principally in the State of New York.

About the year 1910 Mr. W. H. Truesdale, the president of our company, himself a western man and before coming east the general manager of one of the largest of the western granger roads, became impressed with the way in which our national food production was being overtaken by domestic consumption, so that not only was the margin for export rapidly reaching the vanishing point, but the unprecedented condition apparently approaching when America would not produce enough foodstuffs for her growing population. It was about this time that the "back to the farm" and many other visionary, if

not chimerical, ideas were clamoring for public attention. Impressed with the fact that something of a practical and permanent character was necessary to meet the grave and, indeed, threatening situation, Mr. Truesdale delegated me to examine into the various methods of promoting agricultural development and to recommend a line of action for the company to adopt.

It was manifest that the printed bulletins of the Agricultural Department fell far short of accomplishing their theoretical purpose, by reason of the inability of the average man in any line of business to interest himself in the printed page without accompanying demonstration and personal contact. Careful consideration was given to the extensive use of demonstration trains of one kind and another, and while this was believed to be good, it was not thought to be of a sufficiently intensive character, or permanent enough in its results, to accomplish the work which Mr. Truesdale felt was of such pressing necessity.

The question of the use of one or more demonstration and experimental farms was gone into with great care with the valued assistance of Dean Bailey of Cornell Agricultural College, who gave his time and personal attention to the inspection of locations and to the examination of the whole question of the applicability of this means to the needs of the farmers along the Lackawanna Railroad. Three farms in the vicinity of Binghamton were tentatively chosen and options secured for their purchase, but this plan was abandoned by reason of the growing opinion, based upon experiences elsewhere, that farmers could not be induced to visit demonstration farms from any great distance, nor with sufficient frequency to do them lasting good. Furthermore, it was found that there is a tendency with the average farmer to discount the showings of demonstration farms, on the ground that the balance-sheet exhibits as to the profit of various operations are not illustrative or illuminative for the farmer, as the conduct of a business on a large scale by a corporation of real or supposed wealth unconsciously conceals many items of overhead which would entirely destroy the value of the test for the small farmer.

At this stage the advice of the United States Department of Agriculture was sought, and Professor W. J. Spillman, chief

of the Division of Farm Management of the United States Department, and the creator of the idea of the county agency, proved most enthusiastic in laying before us the principles which had already crystallized in his mind, and upon which the county farm bureau of to-day is founded. Professor Spillman's experience with county agents in the south, where they had originally been sent to exterminate the boll weevil, and had gradually developed into general agricultural advisers and had led to the introduction in that section of diversified farming, inspired him with the thought that the ideal unit of scientific, agricultural instruction was the county. He saw that the opportunities which an agricultural expert had in working in a restricted area gave him an advantage over any other possible method, by reason of the fact that it enabled him to get into personal relationships with each farmer, and to add to the mere cold, hard, scientific instruction the persuasive power of personal contact, and, by persistent application upon the individual farmer, to induce him to try the methods which science had proven were good and practicable.

Up to this time there were no county agents in the north, and I believe the term "farm bureau" was entirely unknown. Certainly there was no co-operative county association under the leadership of what are now known as farm bureau agents anywhere in the country. Professor Spillman welcomed the opportunity to experiment in a section such as that of the southern tier of New York, where he believed the conditions ideal to demonstrate the practicability of his plan, and when he found the Lackawanna Railroad ready to contribute the funds necessary for at least one-half of the support of the bureau the first year, and the Binghamton Chamber of Commerce one-fourth, he found funds available in the United States Department for the remainder, and in March, 1911, the Broome County Farm Bureau was organized. This Bureau is the prototype of the farm bureaus in the United States, and the Lackawanna Railroad Company takes a great deal of pride, which we hope you will regard as pardonable, in having been a co-author of that work.

The first year or two of the Broome County Farm Bureau was a very trying one, owing to a variety of causes, such as

the unfamiliarity of the farmers in that particular region with scientific methods, skepticism as to the practicability of anything particularly new or progressive, and, we must admit, a certain hesitancy to accept anything so freely offered by a railroad corporation and a chamber of commerce. The work did not become really successful until an association of farmers was with some little difficulty formed and financial support obtained therefrom. I never saw a better illustration of the fact that where your treasure is there will your heart be also, than in this work, and I am now a firmer believer than ever in the fact that if you want to get a man's interest you had better first get his capital.

This was soon followed by a contribution from the county itself through its board of supervisors, so that to-day these two agencies, the Farm Bureau Association and the board of supervisors, contribute over two-thirds of the total expense. Of course, with the development of the farm bureau throughout the nation, and under the provisions of the Smith-Lever Act, the United States government and the State governments contribute to such farm bureaus, I think, $600 each per annum for their support, in addition to furnishing through the State colleges all of the assistance and direction necessary to make the county agent successful.

Following the Broome County Bureau in 1912 the formation of the farm bureau of Cortland County was brought about by the Lackawanna Railroad on lines similar to these already described. Cortland County has become one of the banner farm bureaus of the United States, and a visit to that county will show you the farmers almost unanimous in its praise. Shortly following that came Chemung County, and then others in rapid succession.

I have just received a letter from Honorable Raymond A. Pearson, assistant secretary of agriculture at Washington. He says: —

I recall clearly your active interest in establishing the county agency in Broome County, New York, in 1911, the first county agency in any northern State. As Commissioner of Agriculture of New York State at that time, it was my privilege to discuss this matter with you. I remember how you took this matter up with the business men and farmers, and

then succeeded in getting an allotment of funds from, and the co-operation of, the Federal Department of Agriculture. This work must have been well done, because it has stood the test of six or seven years, and it has been followed by the location of county agents in a very large number of counties. Of the 2,850 rural counties in this country, 1,900 now have county agents, and about 1,200 of these have women demonstration agents, an outgrowth, by the way, of the farm bureau plan. I always thought that the interest of your road in this matter came from a genuine appreciation of the fact that the railroad business and the farmer's business, to a large extent, depend upon each other. In the present emergency the importance of these great industries in their intimate relations are being emphasized as never before.

Incidentally, if I may be permitted to play upon the phrase "The *Relation* of the Railroad to the Farmer," you may be interested to know that the author of this letter, Raymond A. Pearson, the assistant secretary of agriculture, is a brother of E. J. Pearson, the president of New England's principal railroad.

The county farm bureau under competent management is, in our opinion, unquestionably the best medium not only for disseminating scientific information, but for bringing about among the farmers co-operative action along many lines where until recently they have been suffering seriously from too great a degree of individualism. This feature manifests itself in a variety of ways. On the one hand, we find farmers, through the farm bureaus, purchasing their supplies, agricultural implements, fertilizers and what not at very much more favorable terms than would otherwise be possible, and with a much better prospect of prompt delivery by reason of the quantity of the shipments. On the other hand, they are in many cases making possible the sale and shipment of farm products under much more favorable terms than heretofore, the farm bureau agent being located generally in one of the principal cities of the county, and in contact with the general consuming public, either directly or through the agency of some railroad, thus finding markets of superior attractiveness and securing improved treatment at the hands of the distributors in those markets. The possibilities along the latter line are very great, and we look to see counties acting as units of distribution with very promising results, both to the farmer and to the consumer.

In several other respects, the farm bureaus have, particularly during the past year, proven of a high degree of usefulness. An interesting illustration of this is had in the meeting called by the Lackawanna Railroad at Binghamton, New York, on the 7th of April, 1917, at which the farm bureau managers of 15 counties were present, accompanied each by four of his Farm Bureau Association directors. These 65 representative authorities on farm needs and opportunities were gathered together with some 40 of the leading business men and bankers of Binghamton, Cortland, Norwich and Elmira and one or two other cities, and an entire day was spent in the discussion of ways and means to increase the production of the counties represented to meet the demand for foodstuffs growing out of the entrance of this country into war.

The effects of that meeting have been continuous throughout the subsequent period, and have resulted in a number of important, and, in some cases, original movements. Through the impetus flowing from this meeting, and by the instrumentality of the railroad company, over 30 carloads of seed potatoes, which apparently could not otherwise have been obtained, were brought into the section involved. The use of tractors for plowing has been successfully experimented with, and will undoubtedly be largely increased in the coming season. Perhaps the most notable of all has been the response to the request of the farmers for labor. In this matter the farm bureau agents have acted as a medium for the temporary transfer of employees of manufacturers in Binghamton, Cortland, Norwich and Elmira to the farms of Broome, Cortland, Chenango and Chemung counties. This has been made possible by the unprecedented action of the large employers of labor in those cities in releasing a considerable number of their men for periods of from one to four weeks in the planting and harvesting seasons for general farm labor, to which also the railroad company has contributed a number of its section men for such rough work as plowing. In all cases the city employers have paid their employees the difference between the ruling price of farm labor and the wages which they were receiving in the city. Several hundred men have worked on the farms under this arrangement, and all reports are that it has been of real

value to the farmers in the emergency existing, and has contributed materially to the increase of acreage under cultivation. All of this would have been entirely impossible but for the agency of the farm bureau, through which all of the operations were conducted.

The possibilities of these farm bureaus, aided by the ever-willing service of the railroad company, in the matter of improved methods for securing labor, the introduction of farm machinery, and, particularly, in the yet undeveloped field of better marketing conditions, are, in our opinion, most attractive, and, in fact, hold the promise of greater usefulness than anything yet accomplished.

But I have taxed your patience too long to add to my narrative anything in the nature of prophecy. Indeed, vision best realizes itself by avoiding the uncertain field of prophecy, and I can best close this rather desultory talk by expressing to you the hope of the railroad man whom you have honored with your presence this evening, that we may, as railroad men and farmers, together look forward, as representatives of the nation's two greatest industries, to working shoulder to shoulder in the future, as we have in the past, for the common good of our common country.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

WILFRID WHEELER, SECRETARY.

CIRCULAR No. 83.

March, 1918.

DIRECTIONS FOR GROWING SMALL GRAINS.

WILFRID WHEELER.

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DIRECTIONS FOR GROWING SMALL GRAINS.

Spring Wheat.

Soil. — Wheat will succeed on a wide range of soil avoiding excessively dry or excessively wet. Typical grass land is especially good.

Fertilizers. — Wheat should follow corn or potatoes in the rotation, and so should have some residue from heavy applications of fertilizer and manure on those crops. At present prices of fertilizer and wheat, it will probably pay to apply from 300 to 400 pounds of a 4–10 mixture.

Seed. — One and one-half bushels per acre.

Varieties. — Marquise.

Time of Seeding. — April 15 to May 1 (as soon as ground can be worked); drilled 1 inch deep.

Time of Harvesting. — July or early August (when straw is turning yellow and grain is in dough — soft enough to be easily indented with the thumb nail and hard enough not to be easily crushed between the fingers).

Average Yield. — United States (1917), 14.2 bushels; yields in Massachusetts should average 28 to 30 bushels on good soils.

Oats.

Soil. — Almost any tillable soil will raise oats successfully. Land should not be too rich in nitrogen on account of liability of oats to lodge.

Fertilizers. — The oat crop will not pay for heavy fertilization; 200 to 300 pounds of a 2–8 mixture may be applied at time of seeding, or, if grass seed is sown at same time, this amount may be increased.

Seed. — Two bushels to ten pecks per acre.

Time of Seeding. — April 1 to May 1 (as soon as ground can be worked); oats grow best in moist, cool weather, so seeding should not be delayed; drill about 1 inch deep.

Time of Harvesting. — Late July or early August (in hard dough stage of grain, after straw has turned).

Average Yield. — United States (1917), 36.4 bushels; Massachusetts, 37 bushels.

Buckwheat.

Soil. — A sandy, well-drained soil. Buckwheat is the most adaptable of all the cereals to poor soil.

Fertilizer. — Two hundred pounds of a 2–8 fertilizer, or 250 pounds of acid phosphate alone, will be profitable. If land has been heavily manured recently, the fertilizer may be omitted.

Seed. — One bushel per acre.

Time of Seeding. — June 15 to July 20; not earlier than first date (buckwheat may follow an early cut hay crop).

Time of Harvesting. — Late September (when first grains are fully mature).

Average Yield. — United States (1917), 17.4 bushels; Massachusetts, 15 bushels.

Barley.

Soil. — A fairly heavy but fertile and well-drained soil.

Fertilizers. — Same application as for wheat.

Seed. — One and one-half bushels per acre.

Time of Seeding. — May 1 to June 15.

Time of Harvesting. — September 1 to 15.

Average Yield. — United States (1917), 23.7 bushels.

Winter Rye.

Soil. — Rye is adapted to light sandy soil. It will produce a fair crop on land too poor for wheat, corn or barley.

Fertilizers. — Same as oats.

Seed. — One and one-half bushels per acre.

Time of Seeding. — September 1 to October 25.

Time of Harvesting. — July 5 to 20 (when straw has turned).

Average Yield. — United States (1917), 14.7 bushels; Massachusetts, 19 bushels.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

WILFRID WHEELER, SECRETARY.

CIRCULAR No. 84.

PUBLIC MARKETS IN MASSACHUSETTS.

R. EDWARDS ANNIN, JR.

MARCH, 1918.

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Public Markets in Massachusetts.

R. E. ANNIN, JR., 136 STATE HOUSE, BOSTON, MASS.

Introduction.

All who study into agricultural conditions must realize that the most important factor in the business of farming is the question of marketing. Can I sell my goods at all? Can I sell them at a profit? Where, when and how shall I sell them? These are questions that every business man must ask himself, and the farmer is a business man. The reason for decreases in agricultural production is in most cases not because the farmers do not know how, but because it does not pay. A market must be provided for all goods manufactured or produced, and the market price must be above the cost of production, otherwise the industry fails.

The question of marketing produce is one of the first magnitude and importance, and a question whose ramifications extend far and wide. There is no one best way to sell farm products; the best method will vary with the locality, the product, the man and the type of business. The public market place is no cure-all or panacea for either the seller or the buyer. In some parts of the country the public market has been successful; in others a failure. The whole question of public market places will bear further careful study. They have not been given a thorough enough trial in this State to either acclaim them as a success or condemn them as a failure. The object of this circular is to briefly review the experiences of the towns and cities in the State which have tried out public market places, and to present certain conclusions which this experiment of 1917 seems to justify.

The Public Market Law.

The first organized move to establish public market places in Massachusetts was taken in 1915, when the State Board of Agriculture introduced a bill in the Legislature authorizing

cities and towns of over 10,000 to maintain public markets with buildings, and requiring cities and towns which did not do this to set aside squares or streets for use as public markets. A later section of the law added in 1916 provided for rules and regulations. The full text of the law as it stands to-day is as follows: —

General Acts of 1915, Chapter 119.

Certain Cities and Towns may establish Public Markets.

Section 1. All cities and all towns having a population of ten thousand or more are hereby authorized to provide and maintain public markets with suitable buildings and grounds. For this purpose, any such city or town may, with the approval of the state board of agriculture, take or acquire land by purchase or otherwise, with or without buildings, and may make alterations in buildings and construct new buildings on land so acquired.

Public Market Places.

Section 2. All cities and all towns having a population of ten thousand or more which do not maintain public markets under the provisions of section one hereof shall, within one year after the passage of this act, designate one or more streets or squares, or parts thereof, or other public places, which shall be suitably situated and shall be approved by the state board of agriculture, to be used by farmers and other persons as public market places.

Rules and Regulations.

Section 3.[1] Any city or town which maintains a public market or market place in accordance with the provisions of this act may make rules and regulations for the use and management thereof, subject to the approval of the secretary of the state board of agriculture, and may attach penalties for their violation.

It will be noted that this act does not limit the use of these market places to farmers, nor does it limit the goods sold to farm produce or even food. In a market place situated under this act there is nothing in the law to prevent any person from selling any kind of goods.

Up to March 1, 1918, outdoor markets have been operated in 25 cities and towns under the provisions of section 2 of this act. In addition, indoor markets have been operated in Gardner, Springfield and Worcester, in leased buildings. None of the municipalities has as yet tried the experiment of lo-

[1] Added by General Acts of 1916, chapter 79.

cating permanent market buildings. In a number of cities and towns markets had been provided which were not strictly municipal or town propositions. Some of these were started under the auspices of chambers of commerce, others of local public safety or food production committees. Fifteen of the smaller towns of less than 10,000 in population have established community markets, but these are not treated of in detail in this circular. A list of these towns, secured through the courtesy of the Massachusetts Food Administration, is as follows: —

Barnstable.	North Attleborough.
Cohasset.	Plympton.
Duxbury.	Rockland.
Franklin.	Stockbridge.
Kingston.	Stoughton.
Ludlow.	Uxbridge.
Medfield.	Walpole.
Millis.	

It might be mentioned here that one of the reasons for the success of the Quincy Market was the fact that it was on a well-traveled automobile road. Some of the smaller towns might well imitate this example and have a successful market by appealing to the transient automobile trade where the permanent population would not otherwise justify such a market.

Cities and Towns not operating Public Markets.

The following 23 cities and towns have designated market sites, and these have been approved by the Board of Agriculture, but have not been utilized up to the present time: —

Cities and Towns of over 10,000, which have not operated Public Markets in 1917.

City or Town.	Site designated.
Adams,	East side of Gavin Avenue.
Arlington,	South side of Chestnut Street, east from Mystic Street.
Beverly,	City Square at junction of Cabot, Colon and Rantoul streets.
Clinton,	Union Street, Mechanic to Chestnut Street.
Danvers,	Park Street schoolhouse lot.
Fitchburg,	Broad Street, Newton Place to Putnam Street.
Gloucester,	City Landing, City Landing Square and Town House Square.
Marlborough,	Newton Street, Main Street to Fairmont Street.
	West Marlborough, Broad Street, north from Lincoln Street.
Medford,	Moore Square.
Melrose,	Main Street, between City Hall and fire station.
Methuen,	Railroad Square.
	Tennis Square.
Milford,	School Street, Pine Street to State Street.
Natick,	Middlesex Avenue, Main Street to Spring Street.
New Bedford,	Spring Street, Purchase Street to First Street.
Newburyport,	Market Square, junction of Merrimac, Inn, Water and Liberty streets.
Newton,[1]	Newton Center.
	Newtonville Square.
North Adams,	Corner of River and Marshall streets.
Somerville,	Somerville Avenue, Oak Square to Beacon Street.
Taunton,	Taunton Common, in Taunton Square.
Waltham,	North side of Carter Street.
Webster,	High Street, south from Main Street.
Weymouth,	East Weymouth, Commercial Square.
	North Weymouth, Bicknell Square.
	Weymouth Center, Washington Square.
	South Weymouth, Columbia Square.
Woburn,	Walnut Street, Main Street to Montvale Avenue.

[1] The Newton markets were used for a short time in 1915, but have not been in use since then. Full details of the Newton market have been published by the city of Newton.

Cities and Towns operating Public Markets.

Attleboro. — The city of Attleboro in 1915 designated Monument Square as a market place. This market did not start doing active business until August 11, 1917, when it was started under the direction of the Public Safety Committee,

and ran until September 29, being open a total of fifteen days. A total of about $3,158 worth of produce was handled, or a daily average of about $210. The average number of farmers was 9, and as high as 18 attended in one day. A fee of 20 cents was charged on Wednesdays and 30 cents on Saturdays. The Attleboro Food Production Committee has recommended that a man be engaged to take charge of gardens and the public market for 1918, so that there is every likelihood that the market will be continued.

Boston. — Boston has a wholesale farmers' market in Faneuil Hall Square, which has been open for many years. In August, 1917, the following sites for retail markets were set aside by the city council: —

Monday, Madison Park, Roxbury.
Tuesday, Columbus Avenue, Roxbury Crossing.
Wednesday, Central Square, East Boston.
Thursday, Andrew Square, South Boston.
Saturday, Gibson Street, Dorchester.

These were opened early in September, and were well patronized, with the exception of the South Boston market, which seemed too far away to attract farmers. To the other markets, however, farmers came with auto trucks from as far away as Tewksbury. These markets were not well advertised among the farmers, and with a thorough advertising campaign, preliminary to opening, should attract greater patronage.

Brockton. — In Brockton a municipal market was established by city ordinance at Montello Street, between Court and Center streets. This was never used. In August, 1917, the Public Safety Committee opened a market in a vacant store on Center Street, and this was kept open about two months. The difficulty with an indoor market of this kind is that the farmer has to unload his wagon, carry it in, and arrange it on tables, and this fact undoubtedly drives away many producers who would otherwise come. A fee of 35 cents was charged on Mondays and Saturdays and 25 cents on other other days. There is some talk of opening an outdoor curb market at Brockton for the coming year.

Brookline. — The town of Brookline designated Station Street, between Washington Street and the Boston & Albany

Railroad station as a public market in 1916, but this site was never used. On August 8, 1917, the Public Safety Committee opened a market on the corner of Cypress and School streets, to be in operation on Wednesdays and Saturdays from 7 to 11 A.M. This was patronized on the average by 10 farmers and about 400 buyers, but the reports show that the quantity of business handled was small. No fees were charged.

Cambridge. — The city of Cambridge established a public market in Central Square, which was opened on Saturday, August 18, 1917, and was unquestionably one of the most successful curb markets in the State. The market stayed open until Christmas, and the average attendance at the Wednesday market was 30 farmers, and at the Saturday market, 40. As high as 58 loads of produce were sold in one day. The attendance of buyers was correspondingly good, and though no exact figures are obtainable, it is estimated that over 6,000 people visited the market in one day. A fee of $1 was charged the farmers for each market day. This was the highest fee charged by any town in the State. The city appropriated $500 for running the market. No definite plans have been made for 1918. The mayor reports: "Market has been a great success. Prices average about 33⅓ per cent lower than ruling figures. Our largest market gardeners are selling here and goods are of highest quality."

Dedham. — The town of Dedham in 1916 established High Street, between Eastern Avenue and Williams Street, as a public market, but this has not been used. On September 1, 1917, the Public Safety Committee opened a market in Memorial Hall Square. This market was open on Wednesdays and Saturdays, but lasted only two weeks. A fee of 20 cents was charged on Wednesdays and 30 cents on Saturdays. Only four or five farmers patronized the market, however, though buyers were plenty. As a result the consumers' interest soon waned, and the market met an early death.

Fall River. — Fall River has no farmers' retail market. Plymouth Avenue has been used for some years as a farmers' wholesale market, the business being done early in the morning. No fee is charged. By special edict of the mayor farmers are allowed to stand on any street corner and sell directly to the people, but this method has not proved popular.

Framingham. — The town of Framingham designated Irving Square as a market place in 1915, but this was not used until 1917. In the latter year a group of farmers got together and built a shed on the market site from which they sold farm produce on a commission basis. This market was open from August 11 to October 20, and did a thriving business every day, selling to an average of from 350 to 400 customers. The man who had charge of the booth was able to regulate the supply to suit the demand by telephoning the farmers each night. This unique plan had the additional advantage that the farmers were able to leave their load at the booth and return to their farms, thus saving time. The disadvantage of this plan was that the booth made a permanent obstruction in the street, and there was some objection from the abutters on this account.

Gardner. — The town of Gardner designated Conners Street as a public market in 1915, but this market was never used. On August 18, 1917, a market was opened by the Food Production and Conservation Committee on the West Street school grounds. This market proved very successful, and as many as 27 farmers and several hundred buyers were in attendance in one day. After the close of the market an indoor market was opened, and this is still being successfully operated twice a week in a vacant store (March 5, 1918). In addition to fruits and vegetables, native beef, pork and milk are sold. There is a community table where the market master sells produce for small growers on a 10 per cent basis. A fee of from 50 cents to $1 is charged for farmers selling on the inside market, and a fee of 50 cents was charged at the outdoor market. The gross sales at the indoor market average about $315 per business day. This is the only market in the State, so far as known, which has attempted the sale of milk. The milk is sold in bulk at 10 cents a quart, the buyer bringing his own container.

Greenfield. — In 1916 Main Street, at the junction of Shelburne and Colrain streets, was set aside as a public market by the town of Greenfield, but was not used. In the summer of 1917 a market was opened on a side street on a vacant lot owned by two private citizens. This market was opened in

August, ran for two months and was fairly successful. A shelter was erected on the lot and from 6 to 9 farmers were in attendance. On one day as high as 650 buyers came to the market. The sales the first day (August 10) are reported to have amounted to 3 cents. From this amount market sales increased to over $1,000, the record for the highest day. Greenfield is planning to continue this market on a larger scale next year.

Haverhill. — The city of Haverhill designated the south side of Crescent Place, adjacent to City Hall Park, as a market place. The credit for the inception and operation of the market should go to the Haverhill Woman's Club. This organization worked up the necessary interest for a market, which was started on September 4 and kept open until November 20. An average of 15 farmers patronized the market, which was started on a three-day a week plan, but later was open every day. From 400 to 500 buyers came to the Haverhill market daily. No fees were charged. This market was patronized more largely by the small farmers, but it is probable that in view of its success this year it will be better supported by the larger market gardeners of the vicinity during the coming season.

Holyoke. — The city of Holyoke established Railroad Street as a location for a public market in 1916, but no market was opened until the Agricultural Bureau of the Chamber of Commerce took hold of the proposition and opened two markets, one at the rear of the City Hall and one in South Holyoke. These markets were operated on Tuesdays, Thursdays and Saturdays, beginning on July 24 and keeping open for about sixteen weeks. Four farmers were on hand the first day, and from this small beginning the attendance of farmers rose to a total of 76 on Saturday, September 1, the biggest day. A fee of 25 cents was charged. The Holyoke Chamber of Commerce kept a careful account of the total sales each day, and the writer is indebted to the year book of the Chamber for the following figures. The average market-day business was $450. The maximum return on sales per farmer was $175. The average return on sales per load was $50. The total sales at the market amounted to $30,000. This market was one of the outstanding successes of the State. As many as 3,000 buyers visited the market in one day. (See Figs. 1 and 2).

Lawrence. — The city of Lawrence established as a public market the upper end of Valley Street. This was used during the entire season of 1917, both as a wholesale and retail market, with great success. The supply of produce was large, over 100 farmers patronizing the market at different times and coming from a radius of 12 miles. Buyers visiting the market averaged 1,000. No fees were charged, and the market was used by hucksters to some extent. There is a chance that a shelter may be provided for the market the coming year.

Lowell. — The city of Lowell has for some years had a wholesale market on Green Street. In 1917 a retail market was located in Ann Street, and this was open every day for about three months. As high as 25 farmers used this market, and there were as high as 1,500 buyers in one day, but in the latter part of the season the number of farmers fell off, with a corresponding decrease in number of buyers. No fee was charged at this market. Fig. 3 shows a view of the Lowell market, with a shelter erected by one of the large market gardeners of the vicinity.

Lynn. — A public market was operated by the city of Lynn in West Lynn for about two months during 1917. From 8 to 12 farmers patronized this market, and from 800 to 1,600 consumers. The market was regulated by city ordinance, and control was vested in a board of control consisting of the chief of police, sealer of weights and measures, and inspector of provisions. Each person selling on the market was required to get a permit from the board of control, and the following fees were charged: push carts, 15 cents; single teams, 25 cents; double team or small truck, 35 cents; large truck, 50 cents. This market was used to a considerable extent by hucksters, who in many cases bought directly from farmers who preferred to sell their entire load at one sale rather than retail it in small quantities. It is probable that a similar market will be operated over a longer season in Lynn in 1918.

Norwood. — In 1916 the town of Norwood established the north side of Heaton Avenue, from Washington Street to the railroad, as a public market. This was not used, and in August, 1917, the selectmen changed the site to the Everett School

grounds. This market was operated under the direction of the Norwood Civic Association only one day a week (Saturday), and was visited mostly by small producers. The produce was all sold from tables, a fee of 20 cents being charged; there was also a community table where produce was sold for 8 per cent commission by the Norwood Civic Association. This market had the great disadvantage for farmers that it was open only one day a week, and so farmers were left to find some other way of selling their perishable stuff on the other six days. It is doubtful, however, if there was a sufficient supply of produce in the vicinity of Norwood to warrant keeping the market open oftener. This market was chiefly useful in furnishing an outlet for the surplus of the home gardens of the town. In ten market days a total of 1,709 bushels of produce was sold.

Peabody. — The city of Peabody set aside Railroad Avenue as a public market. This market was opened on August 18, and was operated on Wednesdays and Saturdays until November 3. An average of 8 farmers and 350 buyers attended. The market was also used to some extent by hucksters. No fees were charged. On some Saturdays there were as many as 25 farmers.

Pittsfield. — The city of Pittsfield set aside Clapp Avenue for a public market in 1916, but this was used only in a small way. In the summer of 1917 the Berkshire County Food Production Committee secured a lot at the corner of Wendell Avenue and Federal Street, and a market was opened here on August 31. This market was in operation on Wednesdays and Saturdays until November, and met with very good success. As many as 40 farmers sold goods in one day to from 1,500 to 2,000 buyers. Both local farmers and consumers have expressed themselves as well satisfied with this market, and it will probably be continued another year.

Plymouth. — In Plymouth the south side of Town Square was set aside in 1916, but this site was not used until 1917, when it was opened on August 18 and operated as a Wednesday and Saturday market for about three months. This market did a small business, and it was found difficult to interest the farmers. A fee of 25 cents was charged. An average of 150 to 200

buyers attended the market, but found a scarcity of produce for sale. In 1918 it is planned to locate the market on the main automobile road to the Cape, which will attract considerable transient business. Plans are also being laid to sell fresh fish at this market.

Quincy. — The market in Quincy was managed by the Public Safety Committee, and was one of the first markets in the State to achieve substantial success. This market was opened on the Adams Academy grounds, Hancock Street, which is the main artery of automobile travel between Boston and the South Shore. A large display sign called the attention of the passing automobilist to the market, and thus attracted transient trade. Quincy is not especially favorably located for a farmer's market, as it is not in an agricultural section, but the market was so well advertised that farmers came from as far away as Watertown to sell goods there. A large proportion of the produce sold on the Quincy market was raised by small gardeners in the city. The market was opened on July 14 and ran for four months. As high as 30 farmers and 1,800 consumers attended in one day. Some farmers sold from the wagons and some from tables, which were provided by the Safety Committee at a price of 20 cents on Wednesdays and 30 cents on Saturdays. An appropriation of $350 was made by the Safety Committee to carry on this market, but this was not all used. The market later became self-supporting, and a total business of about $45,000 was done. One reason for the success of this market was that a personal canvass was made among growers two weeks before it started, and so a supply was assured. Full details of the Quincy market will be found in a circular issued on it by the Massachusetts Board of Food Administration.

Revere. — The city of Revere set aside North Square for a market in 1916, but this was not used. In 1917 a market was opened in the latter part of August, and operated on Saturdays only for eleven weeks. Several of the large market gardeners in Revere were induced to try out the market, and it met with fair success. In the vicinity of Revere, however, there are few small farmers, and the large market gardeners are primarily wholesalers, and of necessity must be so, on

account of the size of their operations. For this reason the success of a market is questionable in this city. Plans are being laid, however, to continue another year. A fee of 60 cents was charged at this market.

Salem. — Salem has had a public market place since 1816 in Derby Square, but this has largely drifted out of the hands of farmers and into the hands of hucksters and pedlers. This market was placed under the supervision of a board of control by an ordinance passed in 1915, the members of the board of control being the city marshal, the sealer of weights and measures and the inspector of provisions. Stalls in this market were leased and permits issued.

This market, however, was not really a farmers' curb market, but was more in the nature of the Reading Terminal Market in Philadelphia, or the Central Market in Newark.

On August 18, 1917, the Committee on Food Conservation opened a market on Salem Common, and this was operated on Wednesdays and Saturdays until November 3. The produce was all sold from tables, and as these tables were inside an enclosure the farmers had to unload their wagons, which proved inconvenient. This was a small market, and on the average only 8 to 10 farmers attended. Buyers ranged from 200 to 500 in number. There was a community table, selling on a 10 per cent commission basis, and 25 cents rental was charged for a table.

Saugus. — The town of Saugus assigned three market sites, — Saugus Town Hall Green, East Saugus Center and Cliftondale Common. Markets were operated here for a short time in 1917, but the patronage was small and the markets were not a success. The goods were sold from boxes or tables. Saugus is largely a residential town, and a large proportion of the householders have enough land to raise home gardens. For this reason it seems doubtful whether there will be enough demand for vegetables to support a market, with the possible exception of the Cliftondale section of the town.

Springfield. — The city of Springfield leased a lot on the corner of Vernon Street and Broadway, and the city government appropriated $4,000 for operating a market. This market was operated from August to December. The market accommodated about 80 farmers, and the average number attending

was 60. The market was very centrally located and the patronage was large. On a number of Saturdays the number of customers ran up into the thousands. In addition to having the three requisites of a successful market, — sellers, buyers and goods, — the Springfield market had a market news service maintained by the Office of Markets of the United States Department of Agriculture. This service was of great assistance in keeping both buyers and sellers informed of the supply and prices of farm produce in the Springfield market. Every morning the representative of the Office of Markets in Springfield made the round of the Springfield wholesale markets and secured the quantity of arrivals and the wholesale prices. These were posted on a blackboard at the market as soon as secured, so that both buyer and seller were trading with full knowledge of all the facts in relation to the Springfield market situation for that day.

A small fee was charged sellers in the Springfield market, and this reduced the net cost to the city to about $3,100.

About January 1 an indoor market was opened in Springfield on Fort Street, and this is still in operation at this writing, March 1. Plans are being laid for a continuation of the open market next year, although there is some opposition on the ground of the cost to the city.

Westfield. — The town of Westfield designated Academy Street, a short street running between the high school and the Town Hall, as a market place, and this was opened as a market on September 1, but the proposition was not successful and lasted only a few days.

Worcester. — In 1916 the city of Worcester designated Salem Square as a public market place. This had been used for several years, principally as a wholesale market. In September, 1917, Worcester set aside eight additional market places, namely, square at junction of Cambridge and Millbury streets; square in Merrick Street, north of Pleasant Street; Lincoln Square; Vernon Square; Webster Square; Washington Square; Grafton Square; square at junction of Millbury and Greenwood streets.

By the time that these market places were named the season was too far advanced for them to be given a fair trial in 1917,

but the market places are ready for use for the coming year. During the winter an indoor market place has been conducted under the auspices of the Farm Bureau.

It seems doubtful if the city of Worcester can support as many markets as this. It would probably be advisable if the number were cut down to one or two until those have proved a success.

Conclusion.

Certain tentative conclusions may be drawn from the first year's experience in public markets in Massachusetts, which should be of value to municipalities planning a further continuance of this experiment.

I. Responsible Control.

If such markets are to succeed there must be some responsible control. This is especially essential in order to get the markets started. These markets will not start themselves. In many towns, in 1917, the public market was very effectively handled by the Public Safety Committee; in a few places the initiative came from the women's club or chamber of commerce; in others it was handled directly by the town or city government. The war-garden movement gave the impetus needed to start these markets in many towns, and as the war-garden movement was handled by the public safety committees, it was natural that the same agencies should handle the markets. But public safety committees will not always exist, and the patriotic and unselfish work of the men who compose them cannot be a permanent reliance for the management of these markets. If the demand for these markets and their success is due merely to war conditions, the question of their management after the war is not important; but if they are to have a permanent place in the system of marketing farm products, then some permanent organization must take over their control. Where markets are located on leased property, such an organization as a chamber of commerce can successfully and legitimately oversee them. But the present statute in Massachusetts requires that certain cities and towns shall set aside streets or squares for the use of

these markets. These streets or squares are public property, which leads to the inevitable conclusion that the public, that is, the municipal government, must retain some measure of control over the market located on its property. Such municipal control seems to have been most carefully worked out in Springfield, where the control of the market was vested in a special committee of the board of aldermen.

II. Preliminary Advertising.

The responsible controlling body, whatever it is, must attend to advertising the market in the first instance. As has been stated before, the market to succeed must have buyers, sellers and goods. To bring these three factors together is the task that faces the town which wishes to try this experiment. Markets have been most successful where a personal canvass has been made among neighboring growers to induce them to give them a trial. Farmers are naturally reluctant to use a new and untried method of disposing of their produce, and some of the most vigorous criticisms of the open public markets have come from farmers, but where they have been tried and properly advertised the farmers now seem enthusiastic. Newspaper advertising alone will not do. Nothing gives a market a "black eye" more quickly than for a number of expectant buyers to arrive and find little or nothing for sale; or for farmers to arrive and find no one to buy. This preliminary work is most important and should be thorough.

III. Financial Support.

The market should be self-supporting, and fees sufficient to bring this about should be charged to those selling. The public market is an opportunity which the city offers to farmers in its vicinity, and they should be willing to pay for it. The city has done its part in furnishing the site. However the market is financed, the cost should be kept low. In one or two places there has been some justifiable criticism from taxpayers on account of the size of the municipal appropriation which has been required to run them. If the open public market cannot carry itself financially, it is doubtful if it will meet with permanent success. In most of the markets of the State a flat

rate has been charged to farmers selling. This flat rate has run from 25 cents to $1. It is suggested that instead of a flat rate a sliding scale on a percentage basis be adopted, as it does not seem fair that the farmer who sells only $15 worth of stuff should pay as much as the farmer who sells $60 or $70 worth. The percentage charged can be reduced as the growth of the business of the market increases. The following scale of rates is suggested: —

Scale of Rates.

Gross Business per Day.	Percentage charged.	Income.
$200,	5	$10 00
300,	3½	10 50
500,	2	10 00
1,000,	1½	15 00

In other words, the more successful the market, and the larger the amount of business done, the smaller the burden on the farmer.

If a city wishes to construct buildings for indoor markets, the cost of this will have to be met by the city, but the rent charged for stalls should be made large enough to cover charges on the investment.

IV. Date of Opening.

In 1917 the public market movement did not begin until the season was well advanced, and few markets opened before August 1. Massachusetts farmers, especially growers of fruit and vegetables, are ready to market lettuce, spinach, early beets, peas, strawberries, raspberries and currants in June, and it would seem wise that the markets should be opened at the earliest possible date that there is sufficient marketable produce to warrant it. And farmers should know early in the season whether or not there is to be a public market in their vicinity, in order that, if they wish to take advantage of it, they may plan their plantings accordingly. Testimony from many quarters forces the conclusion that the knowledge that a

public market is to be opened near them will furnish an incentive to many farmers to increase their acreage. The city of Boston is planning to open its retail markets early in April, and this experiment will be watched with interest.

V. Cash and Carry.

It is doubtful if a public market should attempt to deliver orders. The high cost of living comprises three distinct factors, — food, service and credit. The public market is an attempt to furnish another method of buying for that part of the consuming public which is willing to pay cash and carry home their purchases, and the markets will meet with best success if they confine themselves to a cash and carry basis. And the public market will not perform any useful function unless it proves profitable to both farmer and consumer. For this reason the consumer cannot expect the farmer to sell his produce a peck at a time at wholesale rates, nor, on the other hand, can the farmer expect the consumer to pay him the price commanded by a store which has to charge for delivery, credit and bad debts. Somewhere between these extremes lies the economic public market price. The public market will not supplant either the wholesale distributor or the retailer, but will furnish an opportunity to trade for buyers and sellers who are willing to take the trouble to use it. It is almost superfluous to say that there should be no effort at price fixing on the part of those in charge, but daily information on the course of prices and the available supply, as furnished by the Market News Service of the United States Department of Agriculture, will be most useful in enabling both buyer and seller to trade more intelligently.

VI. Daily Market.

In cities where demand justifies it, a daily market will be more satisfactory to farmers than a two or three day a week affair. During the summer a large proportion of the produce sold on these markets is highly perishable in its nature. A farmer who is growing such products in any quantity has something to sell every day, and if the public market is only occasional and intermittent will naturally form other connections for the sale of his produce.

VII. Supply.

Public markets have failed, when they have failed in Massachusetts, for lack of supply rather than lack of demand. If farmers can furnish at these markets a steady and liberal supply at fair prices, there is a consuming public in this State ready to come and buy it. But the public will not readily patronize a market where there is small supply and a narrow range of choice.

VIII. Demand.

The public markets have made many farmers realize the tremendous demand and buying power for food that exists in this State. The market has brought the farmer face to face with large numbers of the consuming public, where heretofore he has dealt only with a few commission merchants or retailers, or the fifteen or twenty families on his private route. The public market, when successful, results in more produce being sold near the point of production, and so less unnecessary long-distance shipping.

To illustrate the consumption of foodstuffs of a small Massachusetts city, compared with the production of the farming territory contiguous to it, the following table shows the summary of a food survey made of the city of Leominster by the Board of Agriculture in 1916. Leominster is a city of 16,000, and is surrounded by good farming territory, the principal crops being apples and milk. The consumption figures were taken from the retail stores, and so do not include the amounts sold directly by farmers nor what is bought in surrounding towns. The production figures were secured directly from the 60 farms which market their produce in this city.

Summary of Food Survey, Leominster, 1916.

Vegetables.	Consumption.	Production.
Asparagus,	310 bushels,	240 bushels.
Beets,	680 bushels,	795 bushels.
Beans,	707 bushels,	210 bushels.
Cabbage,	1,537 barrels,	61 tons.
Carrots,	1,105 bushels,	885 bushels.
Cauliflower,	340 bushels,	250 bushels.
Corn,	17,550 dozen ears,	13,950 dozen.
Lettuce,	2,440 bushels,	Very little.
Onions,	3,620 bushels,	Practically none.
Parsnips,	530 bushels,	Practically none.
Peas,	330 bushels,	12 bushels.
Potatoes,	26,015 bushels,	1,750 bushels.
Squash,	29 tons,	Very little.
Turnips,	1,649 bushels,	40 bushels.
Spinach,	3,293 bushels,	Very little.
Celery,	523 bushels,	Very little.
Cucumbers,	1,015 bushels,	Very few.
Tomatoes,	615 bushels,	1,175 bushels.
Eggs,	329,070 dozen,	18,600 dozen.
Chicken,	34,900 chickens,	5,650 (raised).
Cheese,	61,382 pounds,	Practically none.
Butter,	255,540 pounds,	10,000 pounds.
Milk,	- - -	1,181,140 quarts.
Apples,	1,830 barrels,	4,900 barrels.

With the exception of beets, tomatoes, milk and apples this city appears to be dependent on other sources than the immediate vicinity for its food; and of course no account has been taken of flour, corn meal, beef, or mutton, all of which has to be shipped in.

IX. Farmers' Organization.

Some system by which growers may be notified at short notice of the scarcity of or demand for a certain article will help stabilize the supply, and in like manner gluts may be prevented when the market is oversupplied. Information of this

sort can best be handled by the growers organizing into an association and supplying this service to the members. Such an organization was formed in Framingham last year, and was successful.

This question of a farmers' organization is a very important one, and one that is not perhaps sufficiently emphasized. The public market where the farmers are organized would certainly be more successful than where they are not. The function of the organization should not be to fix prices but to stabilize the supply, and by proper newspaper advertising to create a demand at the necessary times. The retailer uses newspaper publicity freely, and if the public market is to compete with him the same channels probably will have to be used. A small assessment on the membership will purchase advertising enough to make a big increase in demand at the proper times.

Objections to the Public Market.

Several objections have been urged against farmers' retail public markets.

The principal objection has been that farmers could not afford time to sell produce which they needed out home on their farms to grow it. It is certain that they cannot afford this time unless they get sufficient increase over the wholesale price to compensate them for their labor as salesmen. But in many of our towns neighboring farmers have sold their produce to private retail trade, delivering it from house to house, and in many cases allowing their customers to run bills. The public market is fully as economical a method of distribution as this. It will take less of the farmer's time and less horse power. To the very large grower, the man who grows apples by the hundreds of barrels or vegetables by the thousands of boxes, the retail public market will probably not make an attractive appeal, but it is a fact that some of the large growers have availed themselves of the markets to some extent this past year, although the prediction was made that they would not go near them. For the large market gardener it is probable that a wholesale market, such as the market operated in Providence by the Providence Market Gardeners' Association, will be more eco-

Holyoke market one month after opening, August 18, 1917.

A busy moment at the Lowell market.

Opening day at Holyoke market, July 24, 1917.

nomical, but farmers doing a small business need to get more of the consumer's dollars, and seem to be willing to go to some trouble to secure it.

Summary.

To sum up, the public retail market should furnish a new opportunity in marketing, especially for the small and medium-sized grower, and for consumers who are willing to make a little effort in getting their supplies. The amount of food handled in the public markets will necessarily be small compared with the volume which is needed to supply the 3,500,000 people of this State. As has been stated innumerable times, Massachusetts is dependent on outside sources for at least 75 per cent of her food, and this food, shipped in from outside, must go through the regular and established channels of distribution. Massachusetts' climate is such that outside markets can only be open for five, or at most six, months of the year. The markets will handle only fruits and vegetables to any large extent, and so cannot have any effect on the distribution of the staples. In residential towns, where most of the houses are detached and there is land enough for home gardens, the demand for the products which the public market handles is not large enough to promise a large chance of success. The conspicuous failure of markets of this character in several towns during the past year attests the truth of this statement.

It is therefore easy to see that the public market is sharply limited in its field, and those who look on it as an automatic reducer of the cost of living are bound to suffer disappointment. But within its limits, the public market, if properly managed and supported by farmers and consumers, has a place.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

WILFRID WHEELER, SECRETARY.

CIRCULAR No. 84.

PUBLIC MARKETS IN MASSACHUSETTS.

R. EDWARDS ANNIN, JR.

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Public Markets in Massachusetts.

R. E. ANNIN, JR., 136 STATE HOUSE, BOSTON, MASS.

Introduction.

All who study into agricultural conditions must realize that the most important factor in the business of farming is the question of marketing. Can I sell my goods at all? Can I sell them at a profit? Where, when and how shall I sell them? These are questions that every business man must ask himself, and the farmer is a business man. The reason for decreases in agricultural production is in most cases not because the farmers do not know how, but because it does not pay. A market must be provided for all goods manufactured or produced, and the market price must be above the cost of production, otherwise the industry fails.

The question of marketing produce is one of the first magnitude and importance, and a question whose ramifications extend far and wide. There is no one best way to sell farm products; the best method will vary with the locality, the product, the man and the type of business. The public market place is no cure-all or panacea for either the seller or the buyer. In some parts of the country the public market has been successful; in others a failure. The whole question of public market places will bear further careful study. They have not been given a thorough enough trial in this State to either acclaim them as a success or condemn them as a failure. The object of this circular is to briefly review the experiences of the towns and cities in the State which have tried out public market places, and to present certain conclusions which this experiment of 1917 seems to justify.

The Public Market Law.

The first organized move to establish public market places in Massachusetts was taken in 1915, when the State Board of Agriculture introduced a bill in the Legislature authorizing

cities and towns of over 10,000 to maintain public markets with buildings, and requiring cities and towns which did not do this to set aside squares or streets for use as public markets. A later section of the law added in 1916 provided for rules and regulations. The full text of the law as it stands to-day is as follows: —

General Acts of 1915, Chapter 119.

Certain Cities and Towns may establish Public Markets.

Section 1. All cities and all towns having a population of ten thousand or more are hereby authorized to provide and maintain public markets with suitable buildings and grounds. For this purpose, any such city or town may, with the approval of the state board of agriculture, take or acquire land by purchase or otherwise, with or without buildings, and may make alterations in buildings and construct new buildings on land so acquired.

Public Market Places.

Section 2. All cities and all towns having a population of ten thousand or more which do not maintain public markets under the provisions of section one hereof shall, within one year after the passage of this act, designate one or more streets or squares, or parts thereof, or other public places, which shall be suitably situated and shall be approved by the state board of agriculture, to be used by farmers and other persons as public market places.

Rules and Regulations.

Section 3.[1] Any city or town which maintains a public market or market place in accordance with the provisions of this act may make rules and regulations for the use and management thereof, subject to the approval of the secretary of the state board of agriculture, and may attach penalties for their violation.

It will be noted that this act does not limit the use of these market places to farmers, nor does it limit the goods sold to farm produce or even food. In a market place situated under this act there is nothing in the law to prevent any person from selling any kind of goods.

Up to March 1, 1918, outdoor markets have been operated in 25 cities and towns under the provisions of section 2 of this act. In addition, indoor markets have been operated in Gardner, Springfield and Worcester, in leased buildings. None of the municipalities has as yet tried the experiment of lo-

[1] Added by General Acts of 1916, chapter 79.

cating permanent market buildings. In a number of cities and towns markets had been provided which were not strictly municipal or town propositions. Some of these were started under the auspices of chambers of commerce, others of local public safety or food production committees. Fifteen of the smaller towns of less than 10,000 in population have established community markets, but these are not treated of in detail in this circular. A list of these towns, secured through the courtesy of the Massachusetts Food Administration, is as follows: —

Barnstable.	North Attleborough.
Cohasset.	Plympton.
Duxbury.	Rockland.
Franklin.	Stockbridge.
Kingston.	Stoughton.
Ludlow.	Uxbridge.
Medfield.	Walpole.
Millis.	

It might be mentioned here that one of the reasons for the success of the Quincy Market was the fact that it was on a well-traveled automobile road. Some of the smaller towns might well imitate this example and have a successful market by appealing to the transient automobile trade where the permanent population would not otherwise justify such a market.

Cities and Towns not operating Public Markets.

The following 23 cities and towns have designated market sites, and these have been approved by the Board of Agriculture, but have not been utilized up to the present time: —

Cities and Towns of over 10,000, which have not operated Public Markets in 1917.

City or Town.	Site designated.
Adams, ...	East side of Gavin Avenue.
Arlington, . . .	South side of Chestnut Street, east from Mystic Street.
Beverly, ...	City Square at junction of Cabot, Colon and Rantoul streets.
Clinton, ...	Union Street, Mechanic to Chestnut Street.
Danvers, . . .	Park Street schoolhouse lot.
Fitchburg, . . .	Broad Street, Newton Place to Putnam Street.
Gloucester, . . .	City Landing, City Landing Square and Town House Square.
Marlborough, . . .	Newton Street, Main Street to Fairmont Street.
	West Marlborough, Broad Street, north from Lincoln Street.
Medford, . . .	Moore Square.
Melrose, ...	Main Street, between City Hall and fire station.
Methuen, . . .	Railroad Square.
	Tennis Square.
Milford, ...	School Street, Pine Street to State Street.
Natick, . . .	Middlesex Avenue, Main Street to Spring Street.
New Bedford, . .	Spring Street, Purchase Street to First Street.
Newburyport, . .	Market Square, junction of Merrimac, Inn, Water and Liberty streets.
Newton,[1] . . .	Newton Center.
	Newtonville Square.
North Adams, . .	Corner of River and Marshall streets.
Somerville, . . .	Somerville Avenue, Oak Square to Beacon Street.
Taunton, . . .	Taunton Common, in Taunton Square.
Waltham, . . .	North side of Carter Street.
Webster, . . .	High Street, south from Main Street.
Weymouth, . . .	East Weymouth, Commercial Square.
	North Weymouth, Bicknell Square.
	Weymouth Center, Washington Square.
	South Weymouth, Columbia Square.
Woburn, . . .	Walnut Street, Main Street to Montvale Avenue.

[1] The Newton markets were used for a short time in 1915, but have not been in use since then. Full details of the Newton market have been published by the city of Newton.

Cities and Towns operating Public Markets.

Attleboro. — The city of Attleboro in 1915 designated Monument Square as a market place. This market did not start doing active business until August 11, 1917, when it was started under the direction of the Public Safety Committee,

Opening day at Holyoke market, July 24, 1917.

and ran until September 29, being open a total of fifteen days. A total of about $3,158 worth of produce was handled, or a daily average of about $210. The average number of farmers was 9, and as high as 18 attended in one day. A fee of 20 cents was charged on Wednesdays and 30 cents on Saturdays. The Attleboro Food Production Committee has recommended that a man be engaged to take charge of gardens and the public market for 1918, so that there is every likelihood that the market will be continued.

Boston. — Boston has a wholesale farmers' market in Faneuil Hall Square, which has been open for many years. In August, 1917, the following sites for retail markets were set aside by the city council: —

Monday, Madison Park, Roxbury.
Tuesday, Columbus Avenue, Roxbury Crossing.
Wednesday, Central Square, East Boston.
Thursday, Andrew Square, South Boston.
Saturday, Gibson Street, Dorchester.

These were opened early in September, and were well patronized, with the exception of the South Boston market, which seemed too far away to attract farmers. To the other markets, however, farmers came with auto trucks from as far away as Tewksbury. These markets were not well advertised among the farmers, and with a thorough advertising campaign, preliminary to opening, should attract greater patronage.

Brockton. — In Brockton a municipal market was established by city ordinance at Montello Street, between Court and Center streets. This was never used. In August, 1917, the Public Safety Committee opened a market in a vacant store on Center Street, and this was kept open about two months. The difficulty with an indoor market of this kind is that the farmer has to unload his wagon, carry it in, and arrange it on tables, and this fact undoubtedly drives away many producers who would otherwise come. A fee of 35 cents was charged on Mondays and Saturdays and 25 cents on other other days. There is some talk of opening an outdoor curb market at Brockton for the coming year.

Brookline. — The town of Brookline designated Station Street, between Washington Street and the Boston & Albany

Railroad station as a public market in 1916, but this site was never used. On August 8, 1917, the Public Safety Committee opened a market on the corner of Cypress and School streets, to be in operation on Wednesdays and Saturdays from 7 to 11 A.M. This was patronized on the average by 10 farmers and about 400 buyers, but the reports show that the quantity of business handled was small. No fees were charged.

Cambridge. — The city of Cambridge established a public market in Central Square, which was opened on Saturday, August 18, 1917, and was unquestionably one of the most successful curb markets in the State. The market stayed open until Christmas, and the average attendance at the Wednesday market was 30 farmers, and at the Saturday market, 40. As high as 58 loads of produce were sold in one day. The attendance of buyers was correspondingly good, and though no exact figures are obtainable, it is estimated that over 6,000 people visited the market in one day. A fee of $1 was charged the farmers for each market day. This was the highest fee charged by any town in the State. The city appropriated $500 for running the market. No definite plans have been made for 1918. The mayor reports: "Market has been a great success. Prices average about 33⅓ per cent lower than ruling figures. Our largest market gardeners are selling here and goods are of highest quality."

Dedham. — The town of Dedham in 1916 established High Street, between Eastern Avenue and Williams Street, as a public market, but this has not been used. On September 1, 1917, the Public Safety Committee opened a market in Memorial Hall Square. This market was open on Wednesdays and Saturdays, but lasted only two weeks. A fee of 20 cents was charged on Wednesdays and 30 cents on Saturdays. Only four or five farmers patronized the market, however, though buyers were plenty. As a result the consumers' interest soon waned, and the market met an early death.

Fall River. — Fall River has no farmers' retail market. Plymouth Avenue has been used for some years as a farmers' wholesale market, the business being done early in the morning. No fee is charged. By special edict of the mayor farmers are allowed to stand on any street corner and sell directly to the people, but this method has not proved popular.

Framingham. — The town of Framingham designated Irving Square as a market place in 1915, but this was not used until 1917. In the latter year a group of farmers got together and built a shed on the market site from which they sold farm produce on a commission basis. This market was open from August 11 to October 20, and did a thriving business every day, selling to an average of from 350 to 400 customers. The man who had charge of the booth was able to regulate the supply to suit the demand by telephoning the farmers each night. This unique plan had the additional advantage that the farmers were able to leave their load at the booth and return to their farms, thus saving time. The disadvantage of this plan was that the booth made a permanent obstruction in the street, and there was some objection from the abutters on this account.

Gardner. — The town of Gardner designated Conners Street as a public market in 1915, but this market was never used. On August 18, 1917, a market was opened by the Food Production and Conservation Committee on the West Street school grounds. This market proved very successful, and as many as 27 farmers and several hundred buyers were in attendance in one day. After the close of the market an indoor market was opened, and this is still being successfully operated twice a week in a vacant store (March 5, 1918). In addition to fruits and vegetables, native beef, pork and milk are sold. There is a community table where the market master sells produce for small growers on a 10 per cent basis. A fee of from 50 cents to $1 is charged for farmers selling on the inside market, and a fee of 50 cents was charged at the outdoor market. The gross sales at the indoor market average about $315 per business day. This is the only market in the State, so far as known, which has attempted the sale of milk. The milk is sold in bulk at 10 cents a quart, the buyer bringing his own container.

Greenfield. — In 1916 Main Street, at the junction of Shelburne and Colrain streets, was set aside as a public market by the town of Greenfield, but was not used. In the summer of 1917 a market was opened on a side street on a vacant lot owned by two private citizens. This market was opened in

August, ran for two months and was fairly successful. A shelter was erected on the lot and from 6 to 9 farmers were in attendance. On one day as high as 650 buyers came to the market. The sales the first day (August 10) are reported to have amounted to 3 cents. From this amount market sales increased to over $1,000, the record for the highest day. Greenfield is planning to continue this market on a larger scale next year.

Haverhill. — The city of Haverhill designated the south side of Crescent Place, adjacent to City Hall Park, as a market place. The credit for the inception and operation of the market should go to the Haverhill Woman's Club. This organization worked up the necessary interest for a market, which was started on September 4 and kept open until November 20. An average of 15 farmers patronized the market, which was started on a three-day a week plan, but later was open every day. From 400 to 500 buyers came to the Haverhill market daily. No fees were charged. This market was patronized more largely by the small farmers, but it is probable that in view of its success this year it will be better supported by the larger market gardeners of the vicinity during the coming season.

Holyoke. — The city of Holyoke established Railroad Street as a location for a public market in 1916, but no market was opened until the Agricultural Bureau of the Chamber of Commerce took hold of the proposition and opened two markets, one at the rear of the City Hall and one in South Holyoke. These markets were operated on Tuesdays, Thursdays and Saturdays, beginning on July 24 and keeping open for about sixteen weeks. Four farmers were on hand the first day, and from this small beginning the attendance of farmers rose to a total of 76 on Saturday, September 1, the biggest day. A fee of 25 cents was charged. The Holyoke Chamber of Commerce kept a careful account of the total sales each day, and the writer is indebted to the year book of the Chamber for the following figures. The average market-day business was $450. The maximum return on sales per farmer was $175. The average return on sales per load was $50. The total sales at the market amounted to $30,000. This market was one of the outstanding successes of the State. As many as 3,000 buyers visited the market in one day. (See Figs. 1 and 2).

Holyoke market one month after opening, August 18, 1917.

Lawrence. — The city of Lawrence established as a public market the upper end of Valley Street. This was used during the entire season of 1917, both as a wholesale and retail market, with great success. The supply of produce was large, over 100 farmers patronizing the market at different times and coming from a radius of 12 miles. Buyers visiting the market averaged 1,000. No fees were charged, and the market was used by hucksters to some extent. There is a chance that a shelter may be provided for the market the coming year.

Lowell. — The city of Lowell has for some years had a wholesale market on Green Street. In 1917 a retail market was located in Ann Street, and this was open every day for about three months. As high as 25 farmers used this market, and there were as high as 1,500 buyers in one day, but in the latter part of the season the number of farmers fell off, with a corresponding decrease in number of buyers. No fee was charged at this market. Fig. 3 shows a view of the Lowell market, with a shelter erected by one of the large market gardeners of the vicinity.

Lynn. — A public market was operated by the city of Lynn in West Lynn for about two months during 1917. From 8 to 12 farmers patronized this market, and from 800 to 1,600 consumers. The market was regulated by city ordinance, and control was vested in a board of control consisting of the chief of police, sealer of weights and measures, and inspector of provisions. Each person selling on the market was required to get a permit from the board of control, and the following fees were charged: push carts, 15 cents; single teams, 25 cents; double team or small truck, 35 cents; large truck, 50 cents. This market was used to a considerable extent by hucksters, who in many cases bought directly from farmers who preferred to sell their entire load at one sale rather than retail it in small quantities. It is probable that a similar market will be operated over a longer season in Lynn in 1918.

Norwood. — In 1916 the town of Norwood established the north side of Heaton Avenue, from Washington Street to the railroad, as a public market. This was not used, and in August, 1917, the selectmen changed the site to the Everett School

grounds. This market was operated under the direction of the Norwood Civic Association only one day a week (Saturday), and was visited mostly by small producers. The produce was all sold from tables, a fee of 20 cents being charged; there was also a community table where produce was sold for 8 per cent commission by the Norwood Civic Association. This market had the great disadvantage for farmers that it was open only one day a week, and so farmers were left to find some other way of selling their perishable stuff on the other six days. It is doubtful, however, if there was a sufficient supply of produce in the vicinity of Norwood to warrant keeping the market open oftener. This market was chiefly useful in furnishing an outlet for the surplus of the home gardens of the town. In ten market days a total of 1,709 bushels of produce was sold.

Peabody. — The city of Peabody set aside Railroad Avenue as a public market. This market was opened on August 18, and was operated on Wednesdays and Saturdays until November 3. An average of 8 farmers and 350 buyers attended. The market was also used to some extent by hucksters. No fees were charged. On some Saturdays there were as many as 25 farmers.

Pittsfield. — The city of Pittsfield set aside Clapp Avenue for a public market in 1916, but this was used only in a small way. In the summer of 1917 the Berkshire County Food Production Committee secured a lot at the corner of Wendell Avenue and Federal Street, and a market was opened here on August 31. This market was in operation on Wednesdays and Saturdays until November, and met with very good success. As many as 40 farmers sold goods in one day to from 1,500 to 2,000 buyers. Both local farmers and consumers have expressed themselves as well satisfied with this market, and it will probably be continued another year.

Plymouth. — In Plymouth the south side of Town Square was set aside in 1916, but this site was not used until 1917, when it was opened on August 18 and operated as a Wednesday and Saturday market for about three months. This market did a small business, and it was found difficult to interest the farmers. A fee of 25 cents was charged. An average of 150 to 200

buyers attended the market, but found a scarcity of produce for sale. In 1918 it is planned to locate the market on the main automobile road to the Cape, which will attract considerable transient business. Plans are also being laid to sell fresh fish at this market.

Quincy. — The market in Quincy was managed by the Public Safety Committee, and was one of the first markets in the State to achieve substantial success. This market was opened on the Adams Academy grounds, Hancock Street, which is the main artery of automobile travel between Boston and the South Shore. A large display sign called the attention of the passing automobilist to the market, and thus attracted transient trade. Quincy is not especially favorably located for a farmer's market, as it is not in an agricultural section, but the market was so well advertised that farmers came from as far away as Watertown to sell goods there. A large proportion of the produce sold on the Quincy market was raised by small gardeners in the city. The market was opened on July 14 and ran for four months. As high as 30 farmers and 1,800 consumers attended in one day. Some farmers sold from the wagons and some from tables, which were provided by the Safety Committee at a price of 20 cents on Wednesdays and 30 cents on Saturdays. An appropriation of $350 was made by the Safety Committee to carry on this market, but this was not all used. The market later became self-supporting, and a total business of about $45,000 was done. One reason for the success of this market was that a personal canvass was made among growers two weeks before it started, and so a supply was assured. Full details of the Quincy market will be found in a circular issued on it by the Massachusetts Board of Food Administration.

Revere. — The city of Revere set aside North Square for a market in 1916, but this was not used. In 1917 a market was opened in the latter part of August, and operated on Saturdays only for eleven weeks. Several of the large market gardeners in Revere were induced to try out the market, and it met with fair success. In the vicinity of Revere, however, there are few small farmers, and the large market gardeners are primarily wholesalers, and of necessity must be so, on

account of the size of their operations. For this reason the success of a market is questionable in this city. Plans are being laid, however, to continue another year. A fee of 60 cents was charged at this market.

Salem. — Salem has had a public market place since 1816 in Derby Square, but this has largely drifted out of the hands of farmers and into the hands of hucksters and pedlers. This market was placed under the supervision of a board of control by an ordinance passed in 1915, the members of the board of control being the city marshal, the sealer of weights and measures and the inspector of provisions. Stalls in this market were leased and permits issued.

This market, however, was not really a farmers' curb market, but was more in the nature of the Reading Terminal Market in Philadelphia, or the Central Market in Newark.

On August 18, 1917, the Committee on Food Conservation opened a market on Salem Common, and this was operated on Wednesdays and Saturdays until November 3. The produce was all sold from tables, and as these tables were inside an enclosure the farmers had to unload their wagons, which proved inconvenient. This was a small market, and on the average only 8 to 10 farmers attended. Buyers ranged from 200 to 500 in number. There was a community table, selling on a 10 per cent commission basis, and 25 cents rental was charged for a table.

Saugus. — The town of Saugus assigned three market sites, — Saugus Town Hall Green, East Saugus Center and Cliftondale Common. Markets were operated here for a short time in 1917, but the patronage was small and the markets were not a success. The goods were sold from boxes or tables. Saugus is largely a residential town, and a large proportion of the householders have enough land to raise home gardens. For this reason it seems doubtful whether there will be enough demand for vegetables to support a market, with the possible exception of the Cliftondale section of the town.

Springfield. — The city of Springfield leased a lot on the corner of Vernon Street and Broadway, and the city government appropriated $4,000 for operating a market. This market was operated from August to December. The market accommodated about 80 farmers, and the average number attending

A busy moment at the Lowell market.

was 60. The market was very centrally located and the patronage was large. On a number of Saturdays the number of customers ran up into the thousands. In addition to having the three requisites of a successful market, — sellers, buyers and goods, — the Springfield market had a market news service maintained by the Office of Markets of the United States Department of Agriculture. This service was of great assistance in keeping both buyers and sellers informed of the supply and prices of farm produce in the Springfield market. Every morning the representative of the Office of Markets in Springfield made the round of the Springfield wholesale markets and secured the quantity of arrivals and the wholesale prices. These were posted on a blackboard at the market as soon as secured, so that both buyer and seller were trading with full knowledge of all the facts in relation to the Springfield market situation for that day.

A small fee was charged sellers in the Springfield market, and this reduced the net cost to the city to about $3,100.

About January 1 an indoor market was opened in Springfield on Fort Street, and this is still in operation at this writing, March 1. Plans are being laid for a continuation of the open market next year, although there is some opposition on the ground of the cost to the city.

Westfield. — The town of Westfield designated Academy Street, a short street running between the high school and the Town Hall, as a market place, and this was opened as a market on September 1, but the proposition was not successful and lasted only a few days.

Worcester. — In 1916 the city of Worcester designated Salem Square as a public market place. This had been used for several years, principally as a wholesale market. In September, 1917, Worcester set aside eight additional market places, namely, square at junction of Cambridge and Millbury streets; square in Merrick Street, north of Pleasant Street; Lincoln Square; Vernon Square; Webster Square; Washington Square; Grafton Square; square at junction of Millbury and Greenwood streets.

By the time that these market places were named the season was too far advanced for them to be given a fair trial in 1917,

but the market places are ready for use for the coming year. During the winter an indoor market place has been conducted under the auspices of the Farm Bureau.

It seems doubtful if the city of Worcester can support as many markets as this. It would probably be advisable if the number were cut down to one or two until those have proved a success.

Conclusion.

Certain tentative conclusions may be drawn from the first year's experience in public markets in Massachusetts, which should be of value to municipalities planning a further continuance of this experiment.

I. Responsible Control.

If such markets are to succeed there must be some responsible control. This is especially essential in order to get the markets started. These markets will not start themselves. In many towns, in 1917, the public market was very effectively handled by the Public Safety Committee; in a few places the initiative came from the women's club or chamber of commerce; in others it was handled directly by the town or city government. The war-garden movement gave the impetus needed to start these markets in many towns, and as the war-garden movement was handled by the public safety committees, it was natural that the same agencies should handle the markets. But public safety committees will not always exist, and the patriotic and unselfish work of the men who compose them cannot be a permanent reliance for the management of these markets. If the demand for these markets and their success is due merely to war conditions, the question of their management after the war is not important; but if they are to have a permanent place in the system of marketing farm products, then some permanent organization must take over their control. Where markets are located on leased property, such an organization as a chamber of commerce can successfully and legitimately oversee them. But the present statute in Massachusetts requires that certain cities and towns shall set aside streets or squares for the use of

these markets. These streets or squares are public property, which leads to the inevitable conclusion that the public, that is, the municipal government, must retain some measure of control over the market located on its property. Such municipal control seems to have been most carefully worked out in Springfield, where the control of the market was vested in a special committee of the board of aldermen.

II. Preliminary Advertising.

The responsible controlling body, whatever it is, must attend to advertising the market in the first instance. As has been stated before, the market to succeed must have buyers, sellers and goods. To bring these three factors together is the task that faces the town which wishes to try this experiment. Markets have been most successful where a personal canvass has been made among neighboring growers to induce them to give them a trial. Farmers are naturally reluctant to use a new and untried method of disposing of their produce, and some of the most vigorous criticisms of the open public markets have come from farmers, but where they have been tried and properly advertised the farmers now seem enthusiastic. Newspaper advertising alone will not do. Nothing gives a market a "black eye" more quickly than for a number of expectant buyers to arrive and find little or nothing for sale; or for farmers to arrive and find no one to buy. This preliminary work is most important and should be thorough.

III. Financial Support.

The market should be self-supporting, and fees sufficient to bring this about should be charged to those selling. The public market is an opportunity which the city offers to farmers in its vicinity, and they should be willing to pay for it. The city has done its part in furnishing the site. However the market is financed, the cost should be kept low. In one or two places there has been some justifiable criticism from taxpayers on account of the size of the municipal appropriation which has been required to run them. If the open public market cannot carry itself financially, it is doubtful if it will meet with permanent success. In most of the markets of the State a flat

rate has been charged to farmers selling. This flat rate has run from 25 cents to $1. It is suggested that instead of a flat rate a sliding scale on a percentage basis be adopted, as it does not seem fair that the farmer who sells only $15 worth of stuff should pay as much as the farmer who sells $60 or $70 worth. The percentage charged can be reduced as the growth of the business of the market increases. The following scale of rates is suggested: —

Scale of Rates.

Gross Business per Day.	Percentage charged.	Income.
$200,	5	$10 00
300,	3½	10 50
500,	2	10 00
1,000,	1½	15 00

In other words, the more successful the market, and the larger the amount of business done, the smaller the burden on the farmer.

If a city wishes to construct buildings for indoor markets, the cost of this will have to be met by the city, but the rent charged for stalls should be made large enough to cover charges on the investment.

IV. Date of Opening.

In 1917 the public market movement did not begin until the season was well advanced, and few markets opened before August 1. Massachusetts farmers, especially growers of fruit and vegetables, are ready to market lettuce, spinach, early beets, peas, strawberries, raspberries and currants in June, and it would seem wise that the markets should be opened at the earliest possible date that there is sufficient marketable produce to warrant it. And farmers should know early in the season whether or not there is to be a public market in their vicinity, in order that, if they wish to take advantage of it, they may plan their plantings accordingly. Testimony from many quarters forces the conclusion that the knowledge that a

public market is to be opened near them will furnish an incentive to many farmers to increase their acreage. The city of Boston is planning to open its retail markets early in April, and this experiment will be watched with interest.

V. Cash and Carry.

It is doubtful if a public market should attempt to deliver orders. The high cost of living comprises three distinct factors, — food, service and credit. The public market is an attempt to furnish another method of buying for that part of the consuming public which is willing to pay cash and carry home their purchases, and the markets will meet with best success if they confine themselves to a cash and carry basis. And the public market will not perform any useful function unless it proves profitable to both farmer and consumer. For this reason the consumer cannot expect the farmer to sell his produce a peck at a time at wholesale rates, nor, on the other hand, can the farmer expect the consumer to pay him the price commanded by a store which has to charge for delivery, credit and bad debts. Somewhere between these extremes lies the economic public market price. The public market will not supplant either the wholesale distributor or the retailer, but will furnish an opportunity to trade for buyers and sellers who are willing to take the trouble to use it. It is almost superfluous to say that there should be no effort at price fixing on the part of those in charge, but daily information on the course of prices and the available supply, as furnished by the Market News Service of the United States Department of Agriculture, will be most useful in enabling both buyer and seller to trade more intelligently.

VI. Daily Market.

In cities where demand justifies it, a daily market will be more satisfactory to farmers than a two or three day a week affair. During the summer a large proportion of the produce sold on these markets is highly perishable in its nature. A farmer who is growing such products in any quantity has something to sell every day, and if the public market is only occasional and intermittent will naturally form other connections for the sale of his produce.

VII. Supply.

Public markets have failed, when they have failed in Massachusetts, for lack of supply rather than lack of demand. If farmers can furnish at these markets a steady and liberal supply at fair prices, there is a consuming public in this State ready to come and buy it. But the public will not readily patronize a market where there is small supply and a narrow range of choice.

VIII. Demand.

The public markets have made many farmers realize the tremendous demand and buying power for food that exists in this State. The market has brought the farmer face to face with large numbers of the consuming public, where heretofore he has dealt only with a few commission merchants or retailers, or the fifteen or twenty families on his private route. The public market, when successful, results in more produce being sold near the point of production, and so less unnecessary long-distance shipping.

To illustrate the consumption of foodstuffs of a small Massachusetts city, compared with the production of the farming territory contiguous to it, the following table shows the summary of a food survey made of the city of Leominster by the Board of Agriculture in 1916. Leominster is a city of 16,000, and is surrounded by good farming territory, the principal crops being apples and milk. The consumption figures were taken from the retail stores, and so do not include the amounts sold directly by farmers nor what is bought in surrounding towns. The production figures were secured directly from the 60 farms which market their produce in this city.

Summary of Food Survey, Leominster, 1916.

Vegetables.	Consumption.	Production.
Asparagus,	310 bushels,	240 bushels.
Beets,	680 bushels,	795 bushels.
Beans,	707 bushels,	210 bushels.
Cabbage,	1,537 barrels,	61 tons.
Carrots,	1,105 bushels,	885 bushels.
Cauliflower,	340 bushels,	250 bushels.
Corn,	17,550 dozen ears,	13,950 dozen.
Lettuce,	2,440 bushels,	Very little.
Onions,	3,620 bushels,	Practically none.
Parsnips,	530 bushels,	Practically none.
Peas,	330 bushels,	12 bushels.
Potatoes,	26,015 bushels,	1,750 bushels.
Squash,	29 tons,	Very little.
Turnips,	1,649 bushels,	40 bushels.
Spinach,	3,293 bushels,	Very little.
Celery,	523 bushels,	Very little.
Cucumbers,	1,015 bushels,	Very few.
Tomatoes,	615 bushels,	1,175 bushels.
Eggs,	329,070 dozen,	18,600 dozen.
Chicken,	34,900 chickens,	5,650 (raised).
Cheese,	61,382 pounds,	Practically none.
Butter,	255,540 pounds,	10,000 pounds.
Milk,	- - -	1,181,140 quarts.
Apples,	1,830 barrels,	4,900 barrels.

With the exception of beets, tomatoes, milk and apples this city appears to be dependent on other sources than the immediate vicinity for its food; and of course no account has been taken of flour, corn meal, beef, or mutton, all of which has to be shipped in.

IX. Farmers' Organization.

Some system by which growers may be notified at short notice of the scarcity of or demand for a certain article will help stabilize the supply, and in like manner gluts may be prevented when the market is oversupplied. Information of this

sort can best be handled by the growers organizing into an association and supplying this service to the members. Such an organization was formed in Framingham last year, and was successful.

This question of a farmers' organization is a very important one, and one that is not perhaps sufficiently emphasized. The public market where the farmers are organized would certainly be more successful than where they are not. The function of the organization should not be to fix prices but to stabilize the supply, and by proper newspaper advertising to create a demand at the necessary times. The retailer uses newspaper publicity freely, and if the public market is to compete with him the same channels probably will have to be used. A small assessment on the membership will purchase advertising enough to make a big increase in demand at the proper times.

Objections to the Public Market.

Several objections have been urged against farmers' retail public markets.

The principal objection has been that farmers could not afford time to sell produce which they needed out home on their farms to grow it. It is certain that they cannot afford this time unless they get sufficient increase over the wholesale price to compensate them for their labor as salesmen. But in many of our towns neighboring farmers have sold their produce to private retail trade, delivering it from house to house, and in many cases allowing their customers to run bills. The public market is fully as economical a method of distribution as this. It will take less of the farmer's time and less horse power. To the very large grower, the man who grows apples by the hundreds of barrels or vegetables by the thousands of boxes, the retail public market will probably not make an attractive appeal, but it is a fact that some of the large growers have availed themselves of the markets to some extent this past year, although the prediction was made that they would not go near them. For the large market gardener it is probable that a wholesale market, such as the market operated in Providence by the Providence Market Gardeners' Association, will be more eco-

nomical, but farmers doing a small business need to get more of the consumer's dollars, and seem to be willing to go to some trouble to secure it.

Summary.

To sum up, the public retail market should furnish a new opportunity in marketing, especially for the small and medium-sized grower, and for consumers who are willing to make a little effort in getting their supplies. The amount of food handled in the public markets will necessarily be small compared with the volume which is needed to supply the 3,500,000 people of this State. As has been stated innumerable times, Massachusetts is dependent on outside sources for at least 75 per cent of her food, and this food, shipped in from outside, must go through the regular and established channels of distribution. Massachusetts' climate is such that outside markets can only be open for five, or at most six, months of the year. The markets will handle only fruits and vegetables to any large extent, and so cannot have any effect on the distribution of the staples. In residential towns, where most of the houses are detached and there is land enough for home gardens, the demand for the products which the public market handles is not large enough to promise a large chance of success. The conspicuous failure of markets of this character in several towns during the past year attests the truth of this statement.

It is therefore easy to see that the public market is sharply limited in its field, and those who look on it as an automatic reducer of the cost of living are bound to suffer disappointment. But within its limits, the public market, if properly managed and supported by farmers and consumers, has a place.

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

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S. C. VINAL.

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CONTROL OF INSECT ENEMIES OF GARDEN CROPS.

BY S. C. VINAL, M.SC.

From the time garden seeds are planted until the crops are harvested vegetable plants are subject to the attack of many different kinds of destructive insects. In order to combat these pests successfully it is important that the gardener be thoroughly acquainted with the essential points of insect control. The more the gardener knows about the insects liable to attack his crops the better prepared will he be to control them when injury is first detected. For example, it is very important that the gardener should be able to distinguish a chewing insect from a sucking insect, as such knowledge will aid materially in determining the proper remedy to apply.

Injurious insects may be divided, roughly, into two classes, according to the manner in which they feed, viz., (1) chewing insects, which bite off, chew and swallow their food, such as cutworms and other caterpillars, leaf-feeding beetles, grasshoppers, etc.; and (2) sucking insects, which take up food by means of their beaks, such as aphids, squash bugs, scale insects, white flies, etc. If the insect belongs to the chewing type a stomach poison, such as Paris green or arsenate of lead, spread over the material being eaten is usually the best remedy; but if the insect is a sucking species such poisons would be useless, because the insect would insert its beak through the poison and reach a safe place beneath before feeding is begun. For sucking insects, therefore, contact insecticides are essential, such as kerosene emulsion, whale or fish oil soap, and nicotine preparations.

Many of our insect pests, however, may be most economically controlled, not by the use of insecticides, but simply by adapting certain cultural practices so as to avoid or prevent injury.

This method of control necessitates a thorough knowledge of the life history of the insect concerned, in order that such cultural methods may be applied at a time when they will be most effective in reducing the numbers of the pest.

INSECTICIDES AND THEIR APPLICATION.

Insecticides fall, roughly, into two classes: (1) internal or stomach poisons, and (2) external or contact poisons. The former kill by being eaten with the insects' food; the latter, by direct contact with their bodies.

Stomach Poisons for Chewing Insects.

Arsenate of lead, or lead arsenate, is one of the cheapest and safest arsenical poisons for use against insects which destroy foliage. This insecticide is placed on the market in two forms, — as a heavy white paste and as a fine white powder, both being efficient poisons and non-injurious to foliage under normal conditions.

As a spray, use at the rate of 2 pounds of powder or 4 pounds of paste to 50 gallons of water. Where only a few plants are to be treated use 10 level teaspoonfuls of powder or 3 teaspoonfuls of paste to 1 gallon of water. As a dust this poison may be applied to the foliage without being diluted with inert substances. The powder should be used early in the morning, when the plants are wet with dew, or immediately after a light shower.

Paris green is a green crystalline powder which was formerly much recommended for chewing insects, but which is now being largely superseded by arsenate of lead. This condition has resulted from the fact that Paris green has proved very injurious to tender foliage unless applied under ideal conditions and with extreme care.

Resin-soap Sticker. — Upon the smooth and waxy foliage of such plants as cabbage and asparagus it is exceedingly difficult to stick arsenate of lead when used as a spray. To obviate this a resin sticker is usually added. Such a "sticker" can be made by boiling together for about one hour 2 pounds of resin and 1 pound of sal soda (crystals) in a gallon of water. This

is sufficient for 50 gallons of spray. It is more economical, however, to purchase this already made than to attempt its manufacture on a small scale. This "sticker" is sold under the name of resin fish-oil soap, and can be purchased from dealers in insecticides. Use at the rate of 3 pounds to 50 gallons, or 1 ounce to 1 gallon of water.

Poisoned Bran Mash. — For combating cutworms, army worms and grasshoppers arsenic is often applied in a sweetened bran mash. Mix dry 1 pound of Paris green with 25 pounds of bran or middlings. Stir a quart of cheap molasses and the juice of five oranges or lemons, together with the ground-up rinds, into a gallon and a half of water, and moisten the bran, stirring thoroughly until it makes a stiff mash. This amount is sufficient for treating several acres, and should be spread, *thinly,* broadcast. For small gardens a simple formula is 1 quart of bran, 1 teaspoonful of Paris green, 1 tablespoonful of molasses and the juice of one-quarter an orange or lemon, with sufficient water to moisten the bran. Do not add so much water that the mass will be thin and will cake when exposed. Keep poultry out of fields treated with this poisoned mash.

Contact Insecticides for Sucking Insects.

Kerosene Emulsion. — This emulsion is an old standard remedy for sucking insects, but unless prepared with extreme care, so that all the kerosene is emulsified, there is great danger of severely burning or even killing the plants to which it is applied. As there are equally efficient contact insecticides on the market to-day which do not injure plant life, kerosene emulsion is not recommended unless the commercial, prepared brands are used.

Nicotine Sulphate. — Numerous extracts and solutions of tobacco are now sold under various trade names as contact insecticides. These all contain the active alkaloid nicotine in liquid form, and if used properly never injure foliage. Many of these insecticides contain free or volatile nicotine, and are especially useful for fumigation and spraying purposes in greenhouses. For out-of-door spraying, however, these volatile sprays are not as satisfactory as the more stable nicotine sulphate compounds, which are guaranteed to contain 40 per

cent nicotine by weight. Nicotine sulphate is without doubt the safest and most efficient contact insecticide which can be used for the control of sucking insects attacking vegetable crops.

The following formula will be found efficient for the control of the average sucking insect: —

Nicotine sulphate (40 per cent),	½ pint.
Hard soap, dissolved in boiling water,	2 pounds.
Water,	50 gallons.

If only a few plants are to be sprayed, the following mixture should be used.

Nicotine sulphate (40 per cent),	1½ teaspoonfuls.
Hard soap, dissolved in boiling water,	⅔ ounce.
Water,	1 gallon.

The addition of a small amount of soap as recommended is to increase the spreading and wetting properties of the spray. Weigh out the amount of soap desired; shave into small, thin pieces, and boil in a small quantity of water until dissolved. Dilute this dissolved soap with the required amount of water before adding the nicotine sulphate. Stir well before applying. Do not use soap when nicotine sulphate is used in combination with other sprays.

Tobacco dust is of some value both as a repellent and as a contact insecticide, but is only efficient under special conditions.

Soap Solutions. — Soaps of most kinds are valuable as sprays for killing plant lice. Both potash (soft) and soda (hard) soaps are used at the rate of one-half pound in 1 to 2 gallons of water. Whale-oil or fish-oil soaps, sometimes known as potash fish-oil soap, are sold as insecticides, and when used at the rate of 1 pound in 6 to 10 gallons of water prove efficient in controlling plant lice, leaf hoppers, thrips, young squash bugs, etc.

Combination Insecticides and Fungicides.

The cost of spray materials is usually insignificant as compared with the cost of application. One way of reducing the latter expense is by combination spraying; that is, by mixing two or more spray materials and applying them together. In mixtures of this sort marked chemical changes may take place which render the mixtures wholly unfit for use. On the other hand, the original ingredients may remain unchanged or may be improved by the combination. The following table gives the comparative value of some such combination sprays: —

	Fungicide (Bordeaux Mixture).	Contact Insecticides.	
		Soap.	Nicotine Sulphate.
Stomach poisons: —			
Paris green, ...	Better.	Injurious.	Injurious.
Lead arsenate, ...	Efficiency reduced.	Questionable.	Efficient.
Contact insecticides: —			
Soap, ...	Questionable.	–	Better.
Nicotine sulphate, ...	Efficient.	Better.	–

By reference to the table it will be seen that mixtures of soap with lead arsenate or Bordeaux mixture are questionable combinations. Soap is used here only to increase the spreading and adhesive qualities of these sprays. In the majority of cases lead arsenate or Bordeaux mixture may be used alone, as these sprays are markedly adhesive in themselves. However, on such plants as cabbages, asparagus, celery, etc., the waxy bloom and smoothness of the foliage repels these sprays, causing them to gather in large drops and drip from the plants so that a thorough distribution, on which the success of the treatment depends, is not secured. Therefore when spraying such plants the adhesiveness of lead arsenate and Bordeaux mixture is increased by the addition of a "sticker," or soap, which insures a more uniform application over the foliage.

The addition of Bordeaux mixture to arsenate of lead reduces the killing power of the latter about one-third, but it is cheaper

to use an increased amount of the arsenate of lead to overcome this reduced efficiency rather than to make two separate sprayings.

Bordeaux mixture, lead arsenate and nicotine sulphate may be combined with safety, but soap should *never* be added to this mixture.

Application of Insecticides.

Insecticides are applied either in a dry form or as a spray. For the application of the former, dusters, sold by seedsmen, are useful, or the powders may be dusted over the plants from bags made of cheesecloth. Dry powders are best applied when the leaves are wet with dew or immediately after a light rain. For applying liquid insecticides a spraying apparatus is necessary. If spraying is to be conducted on a rather large scale, a power or barrel sprayer will be found most satisfactory, but if only a small area is to be treated a compressed-air sprayer or knapsack pump is most convenient. Bucket pumps or sprayers are useful for spraying small gardens, but two persons are required to operate them. Regardless of the type of pump used, a 3 or 4 foot extension rod with an angle, under-spray nozzle is essential for successful garden spraying. The angle disc nozzle has proved most satisfactory for all-round garden work.

Insecticides should be applied to *prevent* injury, and treatment should always be prompt. Thorough application of spray material is essential for success in insect control. In applying stomach poisons aim to cover all portions of the plant liable to be fed upon, and when using contact insecticides strive to hit every insect attacking the plants.

INSECTS OF THE VEGETABLE GARDEN.

Injurious garden insects may be roughly classified, from the standpoint of their food plants, into two divisions. First, those which are general feeders, or insects which are not particular as to their food plants. These include cutworms and other caterpillars, leaf beetles, thrips, some plant lice and others. Second, those known as special or selective feeders, that is, insects which ordinarily attack only a single crop, or

crops which are very closely related. Examples of insects which confine their feeding to plants of a single family are the asparagus beetle, large green tomato worm, Colorado potato beetle and many others.

General Feeders.

Cutworms.

There are very few gardeners who do not recognize the cause of young plants being severed at the surface of the ground just about the time these get well started. Cutworms are smooth, cylindrical caterpillars, about 1½ inches in length, and grayish or dirty brown in color. They are mostly night feeders, and remain hidden in the ground during the daytime. These insects are general feeders, attacking all kinds of garden plants, particularly when these are young and succulent. Cabbages, cauliflowers, beets, carrots, beans, tomatoes, etc., are readily attacked.

Control. — Poisoned bran mash (see page 5) is probably the best remedy for destroying cutworms, and if thoroughly applied a few evenings before the plants are set, or a few evenings after the seed is planted, will protect crops on infested land. When cutworm damage to plants is noticed, broadcast this mash thinly over the infested gardens. Apply the mash in the early evening, so that it will still be moist when the worms feed at dusk. Keep poultry away from land so treated. Clover or succulent weeds which have been thoroughly sprayed or dipped in water containing one-third pound of Paris green to 50 gallons may be used in the same way with good results if applied to fields before the plants are up.

White Grubs.

Among the most common pests of corn, potatoes and strawberries are large white grubs, the young of common May beetles, or June bugs. These grubs may be at once distinguished from other garden pests by the large brown head, and fat, white body, and their habit of lying curled up in a semicircle. They live naturally in sod land feeding on the roots of grasses, and when new land is turned into a garden the

grubs, being deprived of their usual food, attack the roots of a large number of vegetable crops. The chief destructive species require from two to three years to complete their growth in the grub stage.

Control. — Late fall plowing, which brings many grubs to the surface and exposes them to the adverse weather conditions, is useful. Avoid planting potatoes, beets, corn and other crops likely to be injured on the same land in successive years. When the garden is being prepared, all white grubs detected should be removed by hand and destroyed. Wild birds and domestic fowls feed readily on upturned grubs. Hogs are fond of white grubs, and will root them out and devour them if pastured in the infested area during the fall or spring before plowing. No remedy is known which can be applied under field conditions when the grubs are found destroying the roots of plants, tubers of potatoes, etc.

Wireworms.

These are the young of the so-called "click beetles" or "snapping bugs." They are hard, shining, slender, cylindrical, brown larvæ about three-quarters to 1 inch long, which bore into the seed of corn and other grains and also attack the roots of corn, potatoes, turnips and many other garden crops. The life history is very similar to that of the white grubs, except that from three to five years are sometimes required to complete their life cycle.

Control. — Little can be offered in the way of a satisfactory control for these pests. Midsummer cultivation will destroy many, since they transform to adult beetles at this time, and it has been found that a slight disturbance at this period results in their death. Drainage of fields has also been found effective in reducing injury in some cases. When the wireworms are numerous they may be controlled to some extent by distributing in the garden small bunches of clover or thin slices of potato poisoned with Paris green, over which should be placed small boards or shingles for shelters. To protect seed corn, dip in arsenate of lead paste diluted with water to consistency of thick paint. Dry and plant. Rotate crops that are injured by these insects with peas, beans, clover, etc., which do not seem to be injured to any great extent.

Plant Lice.

Practically all vegetables are subject to attack by various species of plant lice which are also known as "aphids," "aphis" and "green fly." On account of their small size, plant lice are to a great extent unnoticed, but when conditions are favorable to their increase they are capable of seriously damaging plants on which they feed. These small, soft-bodied insects occur as winged and wingless forms, and feed by means of a jointed beak with which they pierce plant tissues and suck the sap. The species which feed upon vegetable crops live for the most part on the under surface of leaves. Plant lice reproduce so rapidly under favorable conditions that they are capable of seriously weakening and even killing their host plants in a short time unless checked by natural enemies or by the application of control measures.

Control. — Since plant lice do not feed on the exposed portion of the leaf, stomach poisons, like arsenate of lead, are useless. Therefore a contact insecticide is necessary. Nicotine sulphate sprays (see page 6) will readily kill these soft-bodied insects. It should be remembered that this is a contact insecticide and kills only the insects actually touched. It is therefore necessary to be very thorough in spraying for the control of plant lice. Spraying should be done promptly, as soon as these pests appear and before they have curled and seriously injured the leaves. Soap preparations (see page 6) are also of value in controlling plant lice in small gardens.

Onion Thrips.

The small yellowish "thrips," which chafe the epidermis from green leaves and suck the juices, causing the plants to dry out, whiten and die, have become well known to onion growers. The adult thrips is about one-twenty-fifth of an inch long, of a pale yellow color, with a blackish tinge. The slender, elongate body bears two pairs of narrow, bristle-like wings, which are of no value for flight. This species attacks a large number of vegetables, including onions, cabbages, cauliflowers, cucumbers, squashes, pumpkins, tomatoes, turnips, etc., as well as numerous other plants and weeds. It often severely injures onions, to a

field of which this insect often causes the appearance described as "white blast" or "silver top." This species is also an important greenhouse pest.

Control. — Clean culture is an important step in the control of this pest when injuring onions. As soon as the onions are harvested all tops and refuse matter should be destroyed by burning, thus preventing thousands of these insects from hibernating. Burning over the edges of the fields is also of benefit in reducing their numbers. When injuring plants in gardens, spray thoroughly with nicotine sulphate (see page 6).

Flea Beetles.

The small, dark colored "flea beetles," so called from their habit of leaping when disturbed, eat small, round holes in the leaves of turnips, radishes, cabbages, potatoes, tomatoes and many other crops. The different species vary from one-twentieth to one-quarter of an inch in length. They are most injurious in spring, at which time young seedlings are often attacked by large numbers of this pest and quickly destroyed. The potato flea beetle, *Epitrix cucumeris* Harris, is one of the most destructive species, feeding on the foliage of potatoes, tomatoes, cabbages, cucumbers, beans, squashes, etc. The turnip flea beetle, *Phyllotreta vittata* Fab., is another very common species, injuring vegetable crops. Several other flea beetles are often found injuring garden plants, but all may be controlled in the same manner.

Control. — Spray infested plants, as soon as these pests appear, with arsenate of lead (see page 4) or Bordeaux mixture (4–4–50), which acts as a deterrent. In either case the spray should be thoroughly applied to both the upper and under surfaces of the leaves. Repeat as often as necessary.

Blister Beetles.

The black blister beetle, *Epicauta pennsylvanica* DeG., the ash-gray blister beetle, *Macrobasis unicolor* Kirby, and the margined blister beetle, *Epicauta marginata* Fab., are the most common species in Massachusetts. All are slender, blackish, cylindrical, soft-bodied insects about one-half an inch in length.

They commonly feed on the foliage of potatoes, beets, beans, peas, carrots, tomatoes, other vegetables and ornamental plants. When abundant they ravenously eat everything in their path.

Control. — Lead arsenate (see page 4) applied at the beginning of the attack is recommended.

Plant Bugs.

The tarnished plant bug, *Lygus pratensis* L., and the four-lined leaf bug, *Poecilocapsus lineatus* Fab., are very general feeders, attacking almost all kinds of garden crops, small fruits, tender shoots of fruit trees, many flowering plants and most of our common weeds. The tarnished plant bug is about one-fifth of an inch in length, light brown in color, with black and yellowish markings, while the four-lined leaf bug is one-quarter of an inch in length, bright greenish yellow in color, with two black spots on the thorax and four stripes of the same color down the back. These insects injure plants by inserting their beaks in the tissues and withdrawing the sap. On many plants a small black spot appears where the insect has been feeding, and this causes a deformation of the part attacked, or tends to "blight" the tip shoots in the case of potatoes, dahlias and similar plants.

Control. — The tarnished plant bug and four-lined leaf bug have been found very difficult to control, owing to their wide range of food plants and to the fact that a large part of the injury is done by the adults, which are so shy and active that it is difficult to hit them with a spray. Much may be done, however, to lessen their numbers by keeping down all weeds in and around the garden. The young may be killed by spraying with nicotine sulphate, one-half pint in 50 gallons of water or $1\frac{1}{4}$ teaspoonfuls in 1 gallon of water, with the addition of soap to increase its spreading qualities; but this treatment is not effective against the adults. Where the adults are abundant they may be collected in considerable numbers by sweeping the foliage in early morning with a strong insect net and then dropping the insects into kerosene.

Rose Chafer.

About the middle to the latter part of June large swarms of the common rose chafer, or rose beetle, *Macrodactylus subspinosus* Fab., often appear and ravenously feed on the flower clusters and foliage of grapes. Although this insect is principally a pest of roses, grapes and many other fruits and ornamental shrubs, when abundant it frequently attacks various garden crops, such as beans, peas, potatoes, etc. The adult beetle is about one-third of an inch long, light brownish in color, covered with numerous lighter hairs, and has long, spiny legs. After feeding three or four weeks the beetles disappear as suddenly as they came, but in the meantime they have deposited eggs in near-by grasslands for the next generation. These soon hatch, and the larvæ feed on the roots of grasses during the summer. In the fall the nearly full-grown larvæ, which closely resemble small white grubs, go below the frost line and spend the winter. In the spring they come near the surface of the soil, transform to pupæ and soon emerge as beetles. There is but one generation a year, and the injury is done by the beetles during the three or four weeks that they are abroad.

Control. — When the beetles are very abundant the only satisfactory method of control is to hand pick and drop them into a can of kerosene and water. They also may be collected in large numbers by sweeping the foliage of both garden crops and surrounding vegetation with a strong insect net. When these pests are not excessively abundant they have been controlled by spraying vegetable plants heavily with arsenate of lead (see page 4), preferably combined with Bordeaux mixture. This spray applied thoroughly to garden crops acts as a repellent, and tends to drive the beetles to other plants for their food.

Snails and Slugs.

Very often these soft-bodied mollusks are decidedly destructive to vegetables, especially young seedlings growing in hotbeds and in cold frames. They feed on the foliage only at night, remaining hidden during the day in some moist, protected place.

Control. — An excellent remedy is to broadcast lightly over the soil, just before dusk, freshly slaked lime. This adheres to their slimy bodies and soon kills them. Three applications on consecutive evenings are advisable. Spraying plants with arsenate of lead is also efficient.

Special or Selective Feeders.

Attacking Asparagus.

1. Asparagus beetles.

Two beetles, about one-fourth of an inch in length, are well-known pests of asparagus; viz., the common asparagus beetle, *Crioceris asparagi* L., and the twelve-spotted asparagus beetle, *Crioceris 12-punctata* L. The former species is steel blue in color, marked with six pale yellow blotches on the wing covers, while the latter is yellowish red with twelve black spots on the wing covers. These beetles cause much damage by feeding on the young, marketable shoots during the spring. Later in the season the beetles and larvæ of the twelve-spotted species appear to feed exclusively on the berries.

Control. — Asparagus beetles should be controlled as far as possible by preventive measures. All old plants and shoots, except a few which may be left as trap plants, should be cut down early in the spring. This will force the beetles to lay their eggs on the young shoots or upon the trap plants. The young asparagus tips should be cut at least every three days, thus preventing the eggs from hatching in the field and the trap plants should be thoroughly sprayed with arsenate of lead (see page 4) to which should be added a resin-soap sticker (see page 4). As soon as the cutting season is over, spray all plants with the above mixture and repeat once or twice at intervals of ten days.

Fresh air-slaked lime dusted on the plants in the morning while the dew is on will destroy the soft-bodied larvæ when it comes in contact with them. Another method of destroying the larvæ of the common asparagus beetle in hot weather is to shake them from the plants so that they will drop on the hot soil. As they crawl but slowly many will die before regaining the plants.

Since the larvæ of the twelve-spotted asparagus beetle develop within the berries, the application of insecticides is of little benefit.

Attacking Beans and Peas.

1. Cutworms (see page 9).
2. Wireworms attacking seed (see page 10).
3. Seed corn maggot attacking seed (see corn insects, page 20).
4. Blister beetles (see page 12).
5. Rose chafer (see page 14).
6. Common bean weevil, *Acanthoscelides obtectus* Say.

The common bean weevil, as well as other closely related species, annually infests quantities of dried beans, rendering them unfit for food or seed. A large proportion of these beans become infested in the field, the eggs being laid upon or inserted in the bean pods by the female weevils. When the beans are harvested the presence of infested seed is rarely noticed, but after they are stored the small, white, footless grubs feeding within the seed reach maturity and transform to small brownish gray weevils. As the common bean weevil is capable of developing in dry seed, eggs are soon deposited on the stored beans and thus infestation continues.

Control. — Since it is extremely difficult to determine whether or not beans are infested when harvested, it is advisable to treat all seed before storing, and thus avoid severe loss. The best means of preventing weevil injury is to fumigate all beans with carbon disulphid before storing them. Carbon disulphid is a colorless liquid which quickly evaporates when exposed to the air. It can be purchased at any drug store and costs very little.

Put the beans to be fumigated in a tight bucket, barrel, bin or room, according to the quantity to be treated. Compute the cubical contents of this container and use the carbon disulphid at the rate of 2 teaspoonfuls per cubic foot of space or 4 pounds to every 1,000 cubic feet of space. Place the required amount of carbon disulphid in a shallow dish on top of the beans, and immediately cover the container to make it as nearly gas-tight as possible. Experience has shown that

the best results are obtained when the gas is allowed to act for twenty-four to forty-eight hours at a temperature above 75 degrees. Do not fumigate when the temperature is below 60 degrees. This treatment will in no way injure the beans for use as food or seed.

Caution. — The gas is not dangerously poisonous to man, but avoid breathing it as far as possible. Carbon bisulphid is highly explosive, and therefore allow no fire of any kind in the vicinity of this gas.

7. Pea weevil, *Mylabris* (Bruchus) *pisorum* L.

This species is a little larger than the bean weevil, but many of their habits are similar. They differ materially, however, in the number of annual generations, for the pea weevil has only one, while the other may have several. Furthermore, only one larva of the pea weevil invades a single pea, and unlike the bean weevil this insect does not breed in dried seed.

Control. — Thoroughly fumigate all peas, before they are stored in the fall, as directed for the control of the bean weevil (see above).

8. Bean aphis, *Aphis rumicis* L.

This minute, blackish plant louse often causes considerable injury to beans.

Control. — Use nicotine sulphate as recommended on page 6.

9. Pea aphis, *Macrosiphum pisi* Kalt.

The pea aphis is one of the larger species of plant lice. It migrates from its winter host, clover, to the young pea vines early in the season, where it clusters about the growing tips causing much injury.

Control. — Spray thoroughly with nicotine sulphate as recommended on page 6.

Attacking Beets and Spinach.

1. Cutworms (see page 9).
2. Wireworms (see page 10).
3. Flea beetles (see page 12).
4. Blister beetles (see page 12).
5. Plant lice (see page 11).
6. Plant bugs (see page 13).

7. Spinach or beet leaf-miner, *Chortophila* (Pegomya) *hyoscyami* Panz.

Beets and spinach plants are often found with raised or blistered blotches or channels in the leaves, these areas eventually turning brown and dying, rendering the plants unfit for greens. The cause of this damage is a small maggot which feeds between the two surfaces of the leaf. The adult of this maggot is a two-winged fly resembling the common house fly, but somewhat smaller. The eggs deposited by the female flies on the leaves hatch into minute maggots which immediately enter the leaves. When full grown the maggots usually leave their channels and pupate in the soil or in some protected place at the base of the plant.

Control. — Unfortunately there is no satisfactory remedy for this insect. In small gardens all blotched leaves should be removed and burned before the maggots leave the foliage to pupate.

Attacking Cabbages, Cauliflowers, Radishes and Turnips.

1. Cutworms (see page 9).
2. Wireworms (see page 10).
3. Flea beetles (see page 12).
4. Cabbage root maggot, *Chortophila* (Pegomya) *brassicae* Bouché.

This is a serious pest of all cruciferous crops. The adult fly resembles the common house fly, but is somewhat smaller. About the time cabbages and cauliflowers are set out, or when radishes and turnips appear above ground, the small, white elongate eggs are deposited by the female flies at the base of the stems. These soon hatch, and the small white maggots at once burrow into and destroy the roots. About one month later the maggots are full grown and leave their host plants to pupate in the soil. Adult flies emerge from these pupæ in a short time and lay eggs for a new generation. Injury thus continues from May until autumn, but the majority of the damage occurs during May and June, when the plants are small.

Control. — Early cabbages and cauliflowers may be protected from attack by placing around the stems discs or collars made of *one-ply tarred felt.* Do not use ordinary tarred build-

ing paper. These discs are circular or polygonal, about 3 inches in diameter, and have a star-shaped cut at the center and a radial slit reaching from the center to the outer edge. As soon as the plants are set in the field, slip a disc around each and press the points formed by the star-shaped cut snugly around the stem. These discs should lie flat on the ground, and care should be taken to keep the upper surface free from dirt when adjusting them. If applied properly they should furnish almost perfect protection.

Late cabbages and cauliflowers should be grown in cheesecloth screened beds until ready for transplanting. A week to ten days before the plants are to be transplanted gradually remove the cheesecloth covering in order to harden the seedlings so that they will be able to stand field conditions. As the damage from root maggots is very slight after July 1, it is rarely necessary to use tarred felt pads on the late crop. Radishes may also be protected from root maggot injury if grown in a screened bed.

Another method used for the control of root maggots when attacking radishes, turnips and onions in small areas consists of repeated applications of carbolic acid emulsion, at weekly intervals, during the months of May and June. For method of making this emulsion, see onion maggot control, page 25.

5. Cabbage aphis, *Aphis brassicae* L. For control, see plant lice, page 11.

6. Cabbage worms.

Several species of green, leaf-eating caterpillars are often injurious to cabbages and related plants. The most injurious species is the imported cabbage worm, *Pontia rapae* L., whose parent is the common white butterfly seen flying in the vicinity of cabbage fields. These caterpillars may all be controlled in the same manner.

Control. — The most effective means of control is spraying or dusting with lead arsenate (see page 4). As the foliage of cabbage is extremely smooth, it is advisable to add 2 or 3 pounds of resin-soap sticker to make the spray more adhesive (see page 4). Plants should be kept well covered with arsenate of lead from the time they are transplanted until the heads are half formed, after which treatment should be discontinued.

Although there is some prejudice against spraying cabbage with arsenicals it is entirely unfounded, for it has been shown that a person would need to eat 28 heads of cabbage at one time, if treated in the usual manner, to secure poisonous effects.

Attacking Celery, Carrots, Parsnips and Parsley.

1. Cutworms (see page 9).
2. Plant lice (see page 11).
3. Plant bugs (see page 13).
4. Leaf-eating caterpillars.

There are several species of leaf-eating caterpillars which attack the above related plants. Those found most commonly are the celery leaf-tyer, *Phlyctaenia ferrugalis* Hbn., the celery looper, *Autographa simplex* Guen., and the celery caterpillar, *Papilio polyxenes* Fab. The latter species is a large, conspicuous green or yellowish caterpillar ringed with black. All are controlled in the same manner.

Control. — Hand picking of the caterpillars is successful in small gardens. In larger areas spraying with arsenate of lead combined with a resin-soap sticker is most effective (see page 4).

Attacking Sweet Corn.

1. Cutworms (see page 9).
2. White grubs (see page 9).
3. Wireworms (see page 10).
4. Seed corn maggot, *Chortophila* (Pegomya) *fusciceps* Zett.

This insect causes considerable damage to the seeds and seedlings of beans, peas and corn. The maggots tunnel in the seed, sprouts and stems of these plants which, when attacked, fail to develop. The life history, habits and appearance of this pest are similar to those of the cabbage root maggot.

Control. — No efficient remedy or preventive measure is known. Seeds should not be planted during a period of cold, damp weather. Use mineral fertilizers where possible, as plants in soils containing much humus are most subject to attack.

5. Stalk borer, *Papaipema nitella* Gn.

Potato and corn plants, together with a number of other plants, and weeds often suffer severely from the attacks of this

mining caterpillar. The feeding of this insect is confined within the stems, stalks or twigs of the host plants, and usually the first evidence of its presence is the wilting of the infested portion. The parent female moths emerge during September and deposit their eggs upon the stems of weeds and grasses. These hatch the following spring, and the young larvæ on finding suitable food plants soon begin their tunneling operations. These caterpillars are readily recognized by the peculiar markings of the body. The larva is whitish brown in color, and is marked with five white stripes, one along the middle of the back and two on each side. The side stripes are absent on the first four segments of the abdomen, giving the larva an appearance of being injured there, because of this darkened area. As the caterpillar matures these stripes become fainter. Usually the injury to crops is only in the outer rows, to which the larvæ have migrated from weeds and grasses growing along the edges of the garden.

Control. — From the life history and habits it is obvious that clean farming is the most practical means of control. Do not allow weeds to grow in or about the garden. Burn over grassland immediately surrounding the garden or field to be planted, in the late fall or early spring. Late fall plowing should be practiced. Where the garden and its borders are kept clean of weeds there will be little damage by this insect.

6. European corn borer, *Pyrausta nubilalis* Hbn.

As far as determined, the European corn borer occurs in this country only within a radius of 15 miles of Boston, where it has seriously attacked sweet corn for the past three or four years. As it promises to be a very important pest, everything possible should be done by the individual gardener to check its multiplication and spread, in order to protect our great western corn crop.

When full grown the caterpillar is 1 inch in length; the body is flesh-colored, with the upper surface somewhat smoky or brownish, and on each side of the median line is a narrow light-colored stripe. On close observation a transverse row of four light brownish spots or tubercles, with two smaller ones immediately behind them, can be seen on each abdominal

segment. These tubercles readily distinguish the European corn borer from our native stalk borer, *Papaipema nitella*, which is a smooth-bodied caterpillar.

With the exception of the leaf blades the whole corn plant above ground is subject to attack. Frequently injury is first noticed when the corn tassel becomes broken over during July. On investigation it will be seen that a caterpillar has entered the terminal part of the stalk and destroyed the central pith. Other larvæ tunnel in the lower portions of the stalk and often bore into the forming ears, destroying them completely. The damage thus far cited is caused by the first brood of larvæ, which reach maturity the latter part of July and transform to moths early in August. Eggs are laid by these moths, and a second generation of caterpillars soon emerge, the majority of which confine their attack to the succulent ears of late corn. Three or four of these caterpillars feeding on the kernels and tunneling through the cob quickly destroy an ear for all purposes except cattle feed. They pass the winter as nearly full-grown larvæ within their tunnels in the stalks, cobs and stubble.

Control. — The fact that they pass the winter within the remains of the food plant suggests an effective control measure in the destruction of the stalks during the fall or winter months. To destroy all borers, corn stalks should be pulled or hoed out and burned. Thorough destruction of all corn stalks, both in the individual gardens and in gardens of a community, is essential to the successful control of this pest, for the occasional stalks which it may seem hardly worth the trouble to clean up are likely to harbor enough borers to severely infest a wide area the next season.

Attacking Cucumbers, Squashes, Pumpkins and Melons.

1. Cutworms (see page 9).
2. Flea beetles (see page 12).
3. Onion thrips (see page 11).
4. Melon aphis, *Aphis gossipii* Glov.

A greenish plant louse which severely injures the vegetables mentioned above, together with a large number of other plants.

Remedial measures should be applied before the leaves begin to curl (see plant lice, page 11).

5. Striped cucumber beetle, *Diabrotica vittata* Fab.

When young cucurbits appear above ground they are often destroyed by over-wintered black and yellow striped beetles less than one-quarter of an inch in length, known commonly as striped cucumber beetles.

Control. — During the early part of the season plants in gardens may be protected if grown beneath a cheesecloth-covered frame. This frame is made by cutting a barrel hoop in two, crossing these half hoops at right angles, and inserting the ends in the ground around the hill. The lower edges of the cheesecloth covering this frame must be held down by stones in order to prevent the beetles from gaining entrance. When the plants begin to run remove the covers and thoroughly spray the upper and under surfaces of the leaves with arsenate of lead, as recommended on page 4.

6. Squash bug, *Anasa tristis* DeG.

This very common pest of cucurbits is dark brown in color and about three-quarters of an inch in length. The brownish egg-clusters are deposited on the under side of the leaves. The light grayish nymphs and adult bugs suck the plant juices, causing the leaves to turn brown and die.

Control. — Early in the season careful search should be made for the egg-clusters, which are readily seen, and these should be cut out and destroyed. The adult bugs cannot be killed by insecticides, but the nymphs may be controlled by spraying with whale-oil or fish-oil soap solution, 1 pound to 5 gallons of water. The adults may be readily trapped by placing small pieces of boards or similar shelters near the vines. The bugs collect under these shelters at night for protection, and may be destroyed after dark or early in the morning.

7. Squash vine borer, *Melittia satyriniformis* Hbn.

This insect is especially destructive to pumpkins and squashes, although melons and cucumbers may be attacked. Damage by this insect results from the larvæ boring in the stalk. This injury frequently results in the death of the stalk, and always causes a loss of vitality.

Control. — Very little can be done after the plants are attacked, except to cut out the borers and cover the infested stems with dirt, thus encouraging the formation of secondary roots. Harrow the fields during the fall and plow deeply in the spring to prevent the moths from emerging from their cells in the ground.

Attacking Onions.

1. Cutworms (see page 9).
2. Wireworms (see page 10).
3. Plant bugs (see page 13).
4. Onion thrips (see page 11).
5. Imported onion maggot, *Chortophila* (Pegomya) *cepetorum* Meade.

This common white maggot, which bores into the roots and bulbs, causing them to wilt and decay, is probably the most important pest of the onion. These maggots are the offspring of small flies which are very similar to the adults of the cabbage root maggot. The eggs are laid on the young plants early in the spring, and the tiny maggots soon appear and bore into the bulb. When full grown they enter the soil, change to pupæ and later emerge as adult flies. These deposit eggs for the succeeding generation. Onions are liable to infestation at any time during the growing season, but usually the most serious damage occurs during June, when the plants are young.

Control. — Liberal application of commercial fertilizers, such as nitrate of soda, which will promote rapid growth, is of great value in overcoming injury by all root-feeding pests.

A method which proves successful in reducing maggot injury in small gardens consists of watering susceptible plants at weekly intervals, from May 10 to the middle or latter part of June, with carbolic acid emulsion. This emulsion is made as follows: —

Hard soap, ...	1 pound.
Boiling water, ...	1 gallon.
Crude carbolic acid, ...	1 pint.

Dissolve the soap in boiling water, add the carbolic acid and churn thoroughly with a bucket pump. This stock solu-

tion thickens on cooling, and should be used at the rate of 1 part of the stock solution to 30 parts of water. This emulsion has also been used successfully for the control of the cabbage root maggot when attacking radishes and turnips.

The best method of controlling the onion maggot is by the application of a poison bait to the plants during May. This will attract the adult flies, which feed upon the poison and are killed before egg-laying takes place. In order to obtain good results the bait should be applied to the plants and other vegetation, checker-board fashion, at weekly intervals, from the time the onions appear above ground until the first or second week in June. During exceptionally rainy seasons it is advisable to apply this bait at shorter intervals. This poison bait is made as follows: —

Sodium arsenate, ...	$\frac{1}{8}$ ounce.
Water, ...	1 gallon.
Cheap molasses, ...	1 pint.

Dissolve the sodium arsenate in boiling water, and after cooling add the molasses.

Attacking Potatoes and Tomatoes.

1. Cutworms (see page 9).
2. White grubs (see page 9).
3. Wireworms (see page 10).
4. Flea beetles (see page 12).
5. Blister beetles (see page 12).
6. Stalk borer (see page 20).
7. Potato plant louse, *Macrosiphum solonifolii* Ashm.

This plant louse caused severe losses during the summer of 1917 in nearly all potato-growing districts. As these small sucking insects usually infest the lower surface of the potato foliage, the contact spray used should be directed so that it will hit them. Thorough application is essential for the successful control of this pest. Nicotine sulphate, as recommended on page 6, is a reliable contact insecticide, and should be applied as soon as infestation is noticed. Whale or fish-oil soap, 1 pound in 6 gallons of water, is also effective (see page 6).

8. Colorado potato beetle, or potato bug, *Leptinotarsa 10-lineata* Say.

This common pest is the most important insect enemy of potatoes. The hemispherical beetles are yellowish in color, with ten longitudinal black lines on the wing covers. From the eggs deposited on the under side of potato foliage emerge reddish, soft-bodied larvæ, or "slugs," which feed ravenously upon the foliage. In four to five weeks these larvæ attain full growth and enter the earth to pupate. They remain in this stage about two weeks and then transform to adult beetles. There are two generations annually in Massachusetts.

Control. — The bugs are readily killed by the use of arsenicals, such as arsenate of lead (see page 4). The vines should be sprayed when they are a few inches high, and the spraying repeated once or twice at intervals of ten days to two weeks, or as often as necessity requires.

9. Three-lined leaf beetle, *Lema 3-lineata* Oliv.

This somewhat common potato pest is closely related to the Colorado potato beetle, but differs in appearance. The beetles are about one-fourth of an inch long, yellow in color, with three black stripes on the wing covers, and resemble somewhat the striped cucumber beetle. The orange-colored eggs are usually laid on the under side of the leaves. The larvæ of this insect are dirty yellow in color, which readily distinguishes them from the reddish larvæ of the Colorado beetle.

Control. — When present these insects may be controlled by the remedies suggested for the Colorado potato beetle.

10. Tomato hornworms, *Phlegethontius* spp.

These large green caterpillars are frequently found feeding on the foliage of tomatoes and tobacco. When full grown the caterpillars are from 3 to 4 inches long, dark green in color, and have oblique V-shaped white lines on each side. The tip of the body bears a long, sharp, curved horn, which distinguishes this insect.

Control. — When not very numerous they may be readily controlled by hand picking. A single application of arsenate of lead, either as a spray or dust, effectively destroys them (see page 4).

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

WILFRID WHEELER, *Secretary.*

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AGRICULTURAL STATISTICS

FOR

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PREFATORY NOTE.

This circular brings together the principal agricultural statistics in relation to the New England States. It includes the total land acreage in each State, the land in farms, the improved land in farms, and the number of farms; also the acreage and production for the last three years of the following crops: corn, wheat, oats, potatoes, apples and hay; and also the total number of cattle, sheep, horses and swine. In the first set of tables the figures are compiled by crops and classes of live stock, and in the second by States.

It is hoped that this circular will be of use to the county agents, agricultural investigators, agricultural speakers and other persons who wish to find quickly agricultural statistics about this section of the country without having to look through bulky census reports to find them.

Agricultural Statistics of New England.

Acreage, Products, etc., for New England.

Maine.

[United States Census, 1910.]

Total land acreage,	19,132,800
Land in farms,	6,296,859
Improved land in farms,	2,360,657
Number of farms,	60,016

[Estimates by the United States Department of Agriculture.]

Products.	1915.		1916.		1917.	
	Acreage.	Bushels.	Acreage.	Bushels.	Acreage.	Bushels.
Corn,	16,000	656,000	15,000	645,000	20,000	780,000
Wheat,	4,000	112,000	5,000	135,000	11,000	154,000
Oats,	175,000	7,000,000	160,000	5,760,000	170,000	4,930,000
Potatoes,	142,000	25,418,000	125,000	25,500,000	150,000	20,250,000

Products.	1915.		1916.		1917.	
	Bushels.	Barrels.[1]	Bushels.	Barrels.	Bushels.	Barrels.
Apples,	–	720,000	5,040,000	425,000[2]	4,617,000	400,000[2]

Products.	1915.		1916.		1917.	
	Acreage.	Tons.	Acreage.	Tons.	Acreage.	Tons.
Hay (cultivated),	1,150,000	1,322,000	1,200,000	1,740,000	1,160,000	1,566,000

Live Stock.	1915.		1916.		1917.	
	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.
Cattle,	159,000	105,000	163,000	112,000	170,000	127,000

Live Stock.	1915.		1916.		1917.	
	Number.	Value.	Number.	Value.	Number.	Value.
Horses,	109,000	$15,478,000	109,000	$16,568,000	109,000	$17,767,000
Sheep,	160,000	768,000	157,000	989,000	163,000	1,532,000
Swine,	102,000	1,224,000	100,000	1,660,000	100,000	2,300,000

[1] The entire crop of apples was estimated by barrels in 1915; in 1916 and 1917 the so-called "total crop" was estimated in bushels, and the commercial crop in barrels. Commercial crop means that part of the crop which finds its way to market.

[2] Commercial crop.

New Hampshire.

[United States Census, 1910.]

Total land acreage,	5,779,840
Land in farms,	3,249,458
Improved land in farms,	929,185
Number of farms,	27,053

[Estimates by the United States Department of Agriculture.]

Products.	1915.		1916.		1917.	
	Acreage.	Bushels.	Acreage.	Bushels.	Acreage.	Bushels.
Corn,	22,000	990,000	19,000	874,000	26,000	1,092,000
Wheat,	–	–	–	–	–	–
Oats,	12,000	456,000	12,000	444,000	14,000	532,000
Potatoes,	16,000	1,520,000	15,000	1,800,000	21,000	2,247,000

Products.	1915.		1916.		1917.	
	Bushels.	Barrels.[1]	Bushels.	Barrels.	Bushels.	Barrels.
Apples,	–	353,000	1,596,000	162,000[2]	1,035,000	120,000[2]

Products.	1915.		1916.		1917.	
	Acreage.	Tons.	Acreage.	Tons.	Acreage.	Tons.
Hay (cultivated),	504,000	504,000	529,000	767,000	506,000	683,000

Live Stock.	1915.		1916.		1917.	
	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.
Cattle,	97,000	63,000	98,000	63,000	102,000	71,000

Live Stock.	1915.		1916.		1917.	
	Number.	Value.	Number.	Value.	Number.	Value.
Horses,	44,000	$5,808,000	44,000	$5,940,000	45,000	$6,795,000
Sheep,	35,000	102,000	35,000	234,000	37,000	392,000
Swine,	55,000	688,000	53,000	827,000	56,000	1,400,000

[1] See note 1 on page 1. [2] Commercial crop.

Vermont.

[United States Census, 1910.]

Total land acreage,	5,839,360
Land in farms,	4,663,577
Improved land in farms,	1,633,965
Number of farms,	32,709

[Estimates by the United States Department of Agriculture.]

Products.	1915.		1916.		1917.	
	Acreage.	Bushels.	Acreage.	Bushels.	Acreage.	Bushels.
Corn,	47,000	2,256,000	45,000	1,935,000	54,000	2,538,000
Wheat,	1,000	30,000	1,000	25,000	3,000	60,000
Oats,	81,000	3,483,000	80,000	2,560,000	88,000	3,168,000
Potatoes,	24,000	2,592,000	23,000	2,576,000	30,000	3,000,000

Products.	1915.		1916.		1917.	
	Bushels.	Barrels.[1]	Bushels.	Barrels.	Bushels.	Barrels.
Apples,	–	324,000	3,312,000	346,000[2]	1,286,000	135,000[2]

Products.	1915.		1916.		1917.	
	Acreage.	Tons.	Acreage.	Tons.	Acreage.	Tons.
Hay (cultivated),	970,000	1,310,000	980,000	1,666,000	945,000	1,531,000

Live Stock.	1915.		1916.		1917.	
	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.
Cattle,	273,000	170,000	281,000	172,000	295,000	189,000

Live Stock.	1915.		1916.		1917.	
	Number.	Value.	Number.	Value.	Number.	Value.
Horses,	89,000	$11,570,000	89,000	$11,926,000	89,000	$12,816,000
Sheep,	100,000	590,000	100,000	730,000	106,000	1,230,000
Swine,	113,000	1,164,000	113,000	1,469,000	120,000	2,664,000

[1] See note 1 on page 1. [2] Commercial crop.

Massachusetts.

[United States Census, 1910.]

Total land acreage,	5,144,960
Land in farms,	2,875,941
Improved land in farms,	1,164,501
Number of farms,	36,917

[Estimates by the United States Department of Agriculture.]

Products.	1915.		1916.		1917.	
	Acreage.	Bushels.	Acreage.	Bushels.	Acreage.	Bushels.
Corn,	48,000	2,304,000	42,000	1,764,000	61,000	2,806,000
Wheat,	–	–	–	–	–	–
Oats,	12,000	432,000	11,000	352,000	12,000	444,000
Potatoes,	26,000	3,120,000	25,000	2,275,000	38,000	4,370,000

Products.	1915.		1916.		1917.	
	Bushels.	Barrels.[1]	Bushels.	Barrels.	Bushels.	Barrels.
Apples,	–	885,000	3,450,000	300,000[2]	2,186,000	225,000[2]

Products.	1915.		1916.		1917.	
	Acreage.	Tons.	Acreage.	Tons.	Acreage.	Tons.
Hay (cultivated),	470,000	705,000	480,000	749,000	460,000	690,000

Live Stock.	1915.		1916.		1917.	
	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.
Cattle,	158,000	85,000	160,000	88,000	154,000	97,000

Live Stock.	1915.		1916.		1917.	
	Number.	Value.	Number.	Value.	Number.	Value.
Horses,	60,000	$8,760,000	59,000	$9,204,000	57,000	$9,291,000
Sheep,	26,000	143,000	25,000	168,000	28,000	288,000
Swine,	112,000	1,478,000	112,000	1,680,000	113,000	2,599,000

[1] See note 1 on page 1. [2] Commercial crop.

Rhode Island.

[United States Census, 1910.]

Total land acreage,	682,880
Land in farms,	443,308
Improved land in farms,	178,344
Number of farms,	5,292

[Estimates by the United States Department of Agriculture.]

Products.	1915.		1916.		1917.	
	Acreage.	Bushels.	Acreage.	Bushels.	Acreage.	Bushels.
Corn,	12,000	516,000	11,000	341,000	13,000	546,000
Wheat,	–	–	–	–	–	–
Oats,	2,000	66,000	2,000	54,000	2,000	62,000
Potatoes,	5,000	550,000	5,000	370,000	5,000	675,000

Products.	1915.		1916.		1917.	
	Bushels.	Barrels.[1]	Bushels.	Barrels.	Bushels.	Barrels.
Apples,	–	59,000	261,000	13,000[2]	198,000	11,000[2]

Products.	1915.		1916.		1917.	
	Acreage.	Tons.	Acreage.	Tons.	Acreage.	Tons.
Hay (cultivated),	57,000	71,000	60,000	81,000	60,000	90,000

Live Stock.	1915.		1916.		1917.	
	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.
Cattle,	22,000	11,000	22,000	11,000	21,000	12,000

Live Stock.	1915.		1916.		1917.	
	Number.	Value.	Number.	Value.	Number.	Value.
Horses,	9,000	$1,359,000	8,000	$1,240,000	8,000	$1,240,000
Sheep,	6,000	35,000	5,000	36,000	6,000	57,000
Swine,	15,000	165,000	14,000	203,000	16,000	400,000

[1] See note 1 on page 1. [2] Commercial crop.

Connecticut.

[United States Census, 1910.]

Total land acreage,	3,084,800
Land in farms,	2,185,788
Improved land in farms,	988,252
Number of farms,	28,815

[Estimates by the United States Department of Agriculture.]

Products.	1915.		1916.		1917.	
	Acreage.	Bushels.	Acreage.	Bushels.	Acreage.	Bushels.
Corn,	65,000	3,250,000	70,000	3,010,000	95,000	4,845,000
Wheat,	–	–	–	–	–	–
Oats,	13,000	422,000	17,000	510,000	20,000	660,000
Potatoes,	24,000	2,280,000	22,000	2,090,000	29,000	3,190,000

Products.	1915.		1916.		1917.	
	Bushels.	Barrels.[1]	Bushels.	Barrels.	Bushels.	Barrels.
Apples,	–	511,000	1,830,000	104,000[2]	1,306,000	75,000[2]

Products.	1915.		1916.		1917.	
	Acreage.	Tons.	Acreage.	Tons.	Acreage.	Tons.
Hay (cultivated),	365,000	493,000	370,000	574,000	350,000	525,000

Live Stock.	1915.		1916.		1917.	
	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.	Milch Cows.	Other Cattle.
Cattle,	119,000	72,000	121,000	73,000	116,000	78,000

Live Stock.	1915.		1916.		1917.	
	Number.	Value.	Number.	Value.	Number.	Value.
Horses,	46,000	$6,716,000	46,000	$6,792,000	45,000	$7,245,000
Sheep,	18,000	104,000	18,000	137,000	20,000	228,000
Swine,	59,000	802,000	58,000	1,015,000	64,000	1,664,000

[1] See note 1 on page 1. [2] Commercial crop.

Acreage Table for New England.

Number of Acres and Farms.

[United States Census, 1910.]

States.	Total Acreage of State.	Land in Farms.	Improved Land in Farms.	Number of Farms.
Maine,	19,132,800	6,296,859	2,360,657	60,016
New Hampshire,	5,779,840	3,249,458	929,185	27,053
Vermont,	5,839,360	4,663,577	1,633,965	32,709
Massachusetts,	5,144,960	2,875,941	1,164,501	36,917
Rhode Island,	682,880	443,308	178,344	5,292
Connecticut,	3,084,800	2,185,788	988,252	28,815
Total,	39,664,640	19,714,931	7,254,904	190,802

Corn.

[Estimates by the United States Department of Agriculture.]

States.	1915.		1916.		1917.	
	Acreage.	Yield in Bushels.	Acreage.	Yield in Bushels.	Acreage.	Yield in Bushels.
Maine,	16,000	656,000	15,000	645,000	20,000	780,000
New Hampshire,	22,000	990,000	19,000	874,000	26,000	1,092,000
Vermont,	47,000	2,256,000	45,000	1,935,000	54,000	2,538,000
Massachusetts,	48,000	2,304,000	42,000	1,764,000	61,000	2,806,000
Rhode Island,	12,000	516,000	11,000	341,000	13,000	546,000
Connecticut,	65,000	3,250,000	70,000	3,010,000	95,000	4,845,000
Total,	210,000	9,972,000	202,000	8,569,000	269,000	12,607,000

Wheat.[1]

[Estimates by the United States Department of Agriculture.]

States.	1915.		1916.		1917.	
	Acreage.	Yield in Bushels.	Acreage.	Yield in Bushels.	Acreage.	Yield in Bushels.
Maine,	4,000	112,000	5,000	135,000	11,000	154,000
Vermont,	1,000	30,000	1,000	25,000	3,000	60,000
Total,	5,000	142,000	6,000	160,000	14,000	210,000

[1] Wheat crop in other New England States not large enough to be reported.

Oats.[1]

[Estimates by the United States Department of Agriculture.]

States.	1915.		1916.		1917.	
	Acreage.	Yield in Bushels.	Acreage.	Yield in Bushels.	Acreage.	Yield in Bushels.
Maine, ...	175,000	7,000,000	160,000	5,760,000	170,000	4,930,000
New Hampshire, .	12,000	456,000	12,000	444,000	14,000	532,000
Vermont, ...	81,000	3,483,000	80,000	2,560,000	88,000	3,168,000
Massachusetts, . .	12,000	432,000	11,000	352,000	12,000	444,000
Rhode Island, . .	2,000	66,000	2,000	54,000	2,000	62,000
Connecticut, . .	13,000	422,000	17,000	510,000	20,000	660,000
Total, ...	295,000	11,859,000	282,000	9,680,000	306,000	9,796,000

[1] A large part of the acreage in oats is cut green or for hay, and so is never ripened.

Potatoes.

[Estimates by the United States Department of Agriculture.]

States.	1915.		1916.		1917.	
	Acreage.	Yield in Bushels.	Acreage.	Yield in Bushels.	Acreage.	Yield in Bushels.
Maine, ...	142,000	25,418,000	125,000	25,500,000	150,000	20,250,000
New Hampshire, .	16,000	1,520,000	15,000	1,800,000	21,000	2,247,000
Vermont, ...	24,000	2,592,000	23,000	2,576,000	30,000	3,000,000
Massachusetts, . .	26,000	3,120,000	25,000	2,275,000	38,000	4,370,000
Rhode Island, . .	5,000	550,000	5,000	370,000	5,000	675,000
Connecticut, . .	24,000	2,280,000	22,000	2,090,000	29,000	3,190,000
Total, ...	237,000	35,480,000	215,000	34,611,000	273,000	31,032,000

Apples.

[Estimates by the United States Department of Agriculture.]

States.	1915.		1916.		1917.	
	Acreage.	Yield in Barrels.[1]	Acreage.	Yield in Bushels.	Acreage.	Yield in Bushels.
Maine,	–	720,000	–	5,040,000 425,000[2]	– –	4,617,000 400,000[2]
New Hampshire,	–	353,000	–	1,596,000 162,000[2]	– –	1,035,000 120,000[2]
Vermont,	–	324,000	–	3,312,000 346,000[2]	– –	1,286,000 135,000[2]
Massachusetts,	–	885,000	–	3,450,000 300,000[2]	– –	2,186,000 225,000[2]
Rhode Island,	–	59,000	–	261,000 13,000[2]	– –	198,000 11,000[2]
Connecticut,	–	511,000	–	1,830,000 104,000[2]	– –	1,316,000 75,000[2]
Total,	–	2,852,000	–	15,489,000 1,350,000[2]	– –	10,638,000 966,000[2]

[1] The entire crop of apples was estimated by barrels.
[2] Barrels; commercial crop.

Hay (Cultivated).

[Estimates by the United States Department of Agriculture.]

States.	1915.		1916.		1917.	
	Acreage.	Yield in Tons.	Acreage.	Yield in Tons.	Acreage.	Yield in Tons.
Maine,	1,150,000	1,322,000	1,200,000	1,740,000	1,160,000	1,566,000
New Hampshire,	504,000	504,000	529,000	767,000	506,000	683,000
Vermont,	970,000	1,310,000	980,000	1,666,000	945,000	1,531,000
Massachusetts,	470,000	705,000	480,000	749,000	460,000	690,000
Rhode Island,	57,000	71,000	60,000	81,000	60,000	90,000
Connecticut,	365,000	493,000	370,000	574,000	350,000	525,000
Total,	3,516,000	4,405,000	3,619,000	5,577,000	3,481,000	5,085,000

Cattle.

[Estimates by the United States Department of Agriculture.]

States.	1915.		1916.		1917.	
	Number of Milch Cows.	Number of Other Cattle.	Number of Milch Cows.	Number of Other Cattle.	Number of Milch Cows.	Number of Other Cattle.
Maine,	159,000	105,000	163,000	112,000	170,000	127,000
New Hampshire,	97,000	63,000	98,000	63,000	102,000	71,000
Vermont,	273,000	170,000	281,000	172,000	295,000	189,000
Massachusetts,	158,000	85,000	160,000	88,000	154,000	97,000
Rhode Island,	22,000	11,000	22,000	11,000	21,000	12,000
Connecticut,	119,000	72,000	121,000	73,000	116,000	78,000
Total,	828,000	506,000	845,000	519,000	858,000	574,000

Sheep.

[Estimates by the United States Department of Agriculture.]

States.	1915.		1916.		1917.	
	Number.	Value.	Number.	Value.	Number.	Value.
Maine,	160,000	$768,000	157,000	$989,000	163,000	$1,532,000
New Hampshire,	35,000	192,000	35,000	234,000	37,000	392,000
Vermont,	100,000	590,000	100,000	730,000	106,000	1,230,000
Massachusetts,	26,000	143,000	25,000	168,000	28,000	288,000
Rhode Island,	6,000	35,000	5,000	36,000	6,000	57,000
Connecticut,	18,000	104,000	18,000	137,000	20,000	228,000
Total,	345,000	$1,832,000	340,000	$2,294,000	360,000	$3,727,000

Horses.

[Estimates by the United States Department of Agriculture.]

States.	1915.		1916.		1917.	
	Number.	Value.	Number.	Value.	Number.	Value.
Maine,	109,000	$15,478,000	109,000	$16,568,000	109,000	$17,767,000
New Hampshire,	44,000	5,808,000	44,000	5,940,000	45,000	6,795,000
Vermont,	89,000	11,570,000	89,000	11,926,000	89,000	12,816,000
Massachusetts,	60,000	8,760,000	59,000	9,204,000	57,000	9,291,000
Rhode Island,	9,000	1,359,000	8,000	1,240,000	8,000	1,240,000
Connecticut,	46,000	6,716,000	46,000	6,792,000	45,000	7,245,000
Total,	357,000	$49,691,000	355,000	$51,670,000	353,000	$55,154,000

Swine.

[Estimates by the United States Department of Agriculture.]

States.	1915.		1916.		1917.	
	Number.	Value.	Number.	Value.	Number.	Value.
Maine, ...	102,000	$1,224,000	100,000	$1,660,000	100,000	$2,300,000
New Hampshire, . .	55,000	688,000	53,000	827,000	56,000	1,400,000
Vermont, ...	113,000	1,164,000	113,000	1,469,000	120,000	2,664,000
Massachusetts, . .	112,000	1,478,000	112,000	1,680,000	113,000	2,599,000
Rhode Island, . .	15,000	165,000	14,000	203,000	16,000	400,000
Connecticut, ...	59,000	802,000	58,000	1,015,000	64,000	1,664,000
Total, ...	456,000	$5,521,000	450,000	$6,854,000	469,000	$11,027,000

The Commonwealth of Massachusetts.

STATE BOARD OF AGRICULTURE.

WILFRID WHEELER, SECRETARY.

CIRCULAR No. 87.

AGRICULTURAL LEGISLATION, 1918.

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AGRICULTURAL LEGISLATION, 1918.

PART I. — LEGISLATION CONFERRING POWERS AND DUTIES ON THE STATE BOARD OF AGRICULTURE AND THE STATE DEPARTMENT OF AGRICULTURE.

STATE-OWNED FARM MACHINERY.

General Acts, Chapter 90.

An Act to authorize the state board of agriculture to purchase farm machinery and lease the same for the use of farmers.

Be it enacted, etc., as follows:

Section 1. There shall be allowed and paid out of the treasury of the commonwealth a sum not exceeding one hundred thousand dollars, to be expended subject to the approval of the governor and council by the state board of agriculture in the purchase of farm machinery and in operating the same or in leasing it to farmers, for use in this commonwealth, upon such terms and for such periods as the board may deem expedient.

Section 2. The provisions of chapter four hundred and ninety-four of the acts of nineteen hundred and eleven, as amended by chapter two hundred and forty of the General Acts of nineteen hundred and sixteen, relating to the hours of labor of public employees, shall not apply to persons employed under the provisions of this act.

Section 3. This act shall take effect upon its passage. [*Approved March 23, 1918.*

STATE AGRICULTURAL PRIZE MONEY.

General Acts, Chapter 241.

An Act to provide state prizes for agricultural exhibits.

Be it enacted, etc., as follows:

Section 1. The state board of agriculture is hereby authorized to offer prizes for competitive exhibits of fruit, flowers, vegetables, grasses, grains or other farm crops, dairy products, honey, horses, cattle, sheep, swine, poultry and poultry products and farm operations. The board shall make rules and regulations for carrying out the provisions of this act, and may expend for the purpose such sums as shall be appropriated therefor by the general court.

Section 2. Chapter three hundred and nineteen of the acts of nineteen hundred and thirteen, as amended by chapter two hundred and sixty-

seven of the acts of nineteen hundred and fourteen; chapter four hundred and twenty-seven of the acts of nineteen hundred and ten; and chapter four hundred and eleven of the acts of nineteen hundred and twelve, are hereby repealed.

SECTION 3. Section two of this act shall take effect on the first day of December, nineteen hundred and eighteen. The remainder of the act shall take effect upon its passage. [*Approved May 28, 1918.*

APPLE GRADING.

GENERAL ACTS, CHAPTER 169.

AN ACT RELATIVE TO THE GRADING AND BRANDING OF APPLES.

Be it enacted, etc., as follows:

SECTION 1. Chapter two hundred and sixty-one of the General Acts of nineteen hundred and fifteen, as amended in section three by section two of chapter sixty-three of the General Acts of nineteen hundred and sixteen, is hereby further amended by striking out said section three and substituting the following: — *Section 3.* The marks indicating the grade, as above prescribed, shall not be accompanied by any other designation of grade or brand which is inconsistent with or marked more conspicuously on the package than the mark or marks required by section five of this act.

SECTION 2. Section fourteen of said chapter two hundred and sixty-one is hereby amended by striking out the word "one", in the tenth line, and substituting the word: — two, — so as to read as follows: — *Section 14.* Any person who adulterates or misbrands apples within the meaning of this act, or who packs, repacks, sells, distributes, or offers or exposes for sale or distribution, apples in violation of any provision of this act, or who wilfully alters, effaces or removes, or causes to be altered, effaced or removed, wholly or partly, any brands or marks required to be put upon any closed package under the provisions of this act, shall be punished by a fine not exceeding fifty dollars for the first offence, and by a fine not exceeding two hundred dollars for each subsequent offence.

SECTION 3. Said chapter two hundred and sixty-one, as amended by said chapter sixty-three, is hereby further amended by adding thereto the following new sections: — *Section 17.* Apples shipped in the course of interstate commerce and packed and branded in accordance with the provisions of the act of congress approved August third, nineteen hundred and twelve, and known as "The United States Apple Grading Law", shall be exempt from the provisions of this act. *Section 18.* The secretary of the state board of agriculture and his duly authorized agent shall have authority to enforce the provisions of this act and to prosecute all violations thereof.

SECTION 4. This act shall take effect upon its passage. [*Approved April 24, 1918.*

IMPORTATION OF NURSERY STOCK.

General Acts, Chapter 193.

An Act relative to the authority of the state nursery inspector, in respect to importation of nursery stock.

Be it enacted, etc., as follows:

Section twelve of chapter five hundred and seven of the acts of nineteen hundred and twelve is hereby amended by inserting after the word "agriculture", in the second line, the words: — after a duly advertised public hearing with notice to interested parties, — and by striking out the words "not already present in this state", in the seventh and eighth lines, and substituting the words: — , or is liable to act as a carrier of insect pests or diseases, — so as to read as follows: — *Section 12.* The state nursery inspector, with the approval of the secretary of the state board of agriculture, after a duly advertised public hearing with notice to interested parties, may prohibit for such periods and under such conditions as in his judgment may seem necessary, the delivery within the state of nursery stock from any other state, province or country when in his opinion such nursery stock is liable to be infested with insect pests or diseases, or is liable to act as a carrier of insect pests or diseases. He, with the approval of the secretary of the state board of agriculture, shall have power to prescribe such general requirements as may be needed to carry out the provisions of this act, and may publish information about such insects and diseases as are concerned in this act. [*Approved May 3, 1918.*

COMPENSATION FOR BERRY-BEARING SHRUBBERY.

General Acts, Chapter 215.

An Act to provide compensation for damages incident to checking the spread of the white pine blister rust.

Be it enacted, etc., as follows:

Section 1. The owner of any cultivated berry-bearing shrubbery destroyed by the state nursery inspector or his agents acting under the provisions of chapter five hundred and seven of the acts of nineteen hundred and twelve, as amended by chapter one hundred and sixty-one of the General Acts of nineteen hundred and fifteen, by chapter ninety-one of the General Acts of nineteen hundred and sixteen and by chapter two hundred and sixty-three of the General Acts of nineteen hundred and seventeen, for the purpose of checking the spread of the white pine blister rust, shall receive compensation therefor from the commonwealth, provided that he shall, within thirty days after the accrual of his claim to compensation if the same accrues after the passage of this act, and within sixty days after the date of the passage of this act, if his claim accrued before that date, give notice in writing thereof to the state nursery in-

spector. The said inspector shall thereupon personally, or by his deputy, investigate the same, and in case he is unable to agree with the claimant as to the validity of his claim or as to the amount thereof, the questions at issue shall be determined by three arbitrators, to be composed of the secretary of the state board of agriculture, the state forester, and an assistant attorney-general to be designated by the attorney-general. Any award of damages made by the arbitrators shall be certified to the auditor of the commonwealth, together with the costs of appraisal, and the said damages and costs shall thereupon be paid from the treasury of the commonwealth in the same manner as other claims.

SECTION 2. To carry out the provisions of this act there may be expended from the treasury of the commonwealth during the current fiscal year, the sum of eight thousand dollars.

SECTION 3. This act shall take effect upon its passage. [*Approved May 21, 1918.*

PEAT INVESTIGATION.

RESOLVES, CHAPTER 49.

RESOLVE PROVIDING FOR A REPORT BY THE STATE BOARD OF AGRICULTURE AND THE STATE DEPARTMENT OF HEALTH ON THE EXPEDIENCY OF UTILIZING THE PEAT DEPOSITS IN THE COMMONWEALTH.

Resolved, That the state board of agriculture and the state department of health, acting jointly under the provisions of chapter two hundred and twelve of the General Acts of nineteen hundred and seventeen, be directed to consider the expediency of utilizing for fuel and other purposes the peat deposits within the commonwealth, and to make in their annual report under the said chapter such recommendations relative thereto as may appear advisable. [*Approved April 26, 1918.*

ESTABLISHMENT OF STATE DEPARTMENT OF AGRICULTURE.

GENERAL ACTS, CHAPTER 268.

AN ACT TO ESTABLISH THE STATE DEPARTMENT OF AGRICULTURE.

Be it enacted, etc., as follows:

SECTION 1. The state board of agriculture as constituted under authority of chapter eighty-nine of the Revised Laws, and acts in amendment thereof and in addition thereto, is hereby abolished. All the rights, powers and duties pertaining to said board are hereby transferred to, and shall hereafter be vested in and exercised by the state department of agriculture, established hereunder, which shall in all respects be the lawful successor of said board. Immediately upon the qualification of the members of said department but not prior to the first day of September, nineteen hundred and eighteen, all books, papers, maps, plans, charts,

records and all other documents, machinery, appliances or equipment in the possession of the said board shall be delivered to said department. All the present employees of the said board shall continue as temporary appointees to perform their usual duties upon the same terms and conditions as heretofore, and shall be eligible for appointment by said department, or by the commissioner of said department, without further civil service examination.

Section 2. The state department of agriculture shall consist of a commissioner, to be known as the commissioner of agriculture, and fourteen associate members, to wit: — one from each of the several counties of the commonwealth. The governor with the advice and consent of the council shall appoint four of said associate members for terms of three years, five for two years, and five for one year. The initial terms of said appointees shall begin on the first day of September in the year nineteen hundred and eighteen. As the term of each member expires, the governor shall in like manner appoint his successor for a term of three years, shall fill any vacancy for the unexpired term, and may for cause at any time, with the consent of the council, remove any associate member. At their first meeting after qualification the associate members shall elect the commissioner for a term of three years beginning with the first day of September, nineteen hundred and eighteen, and at the expiration of the term shall elect his successor, and may at any time fill a vacancy in the office for the unexpired term. The associate members may for cause at any time remove the commissioner. The principal vocation of at least eight of the associate members shall be agriculture.

Section 3. The commissioner shall receive an annual salary of three thousand dollars. The associate members shall receive their actual travelling expenses and ten dollars for each day of actual service. The department shall have suitable quarters in the state house, and shall meet whenever called together by the commissioner, and meetings shall be called at any time upon the request of five or more associate members.

Section 4. The office of secretary of the state board of agriculture, existing under authority of said chapter eighty-nine and amendments thereof, is hereby abolished. All the rights, powers and duties pertaining to the said office are hereby transferred to, and shall hereafter be vested in and exercised by the commissioner of agriculture, who shall be the administrative and executive head of the state department of agriculture.

Section 5. So much of this act as provides for the appointment of the members of the state department of agriculture, and the election of the commissioner of agriculture, shall take effect upon its passage. The remainder shall take effect on the first day of September in the current year. [*Approved May 31, 1918.*

LAND DRAINAGE.

General Acts, Chapter 289.

An Act relative to the improvement of certain low land.

Be it enacted, etc., as follows:

Section 1. If it is necessary or useful to drain or flow a meadow, swamp, marsh, beach, or other low land which is held by several proprietors, or remove obstructions in rivers or streams leading therefrom, such improvements may be made as hereinafter provided.

Section 2. One member of the state department of health designated by said department, and one member of the state board of agriculture designated by said board, shall constitute a board to be known as the drainage board in carrying out the provisions of this act. Said board shall serve without additional compensation and is hereby authorized to investigate the question of utilizing the wet lands in the commonwealth, including meadows, swamps, marshes, beaches and other low lands, and to ascertain what lands, if any, in the commonwealth may advantageously be drained for agricultural and industrial uses, the protection of the public health, the utilization of deposits therein, or for other purposes. Said board may publish and disseminate facts of general interest ascertained in the conduct of the investigation hereby authorized, and may make and publish surveys of tracts of land in need of drainage, showing their situation, area and outlets, the best methods and the cost of draining them, the uses to which they are best adapted, and such other details as may be deemed advisable. The said board shall report annually to the legislature its doings hereunder in the preceding year. The board may expend during the current fiscal year a sum not exceeding one thousand dollars.

Section 3. In carrying out the provisions of this act the said board shall seek the co-operation and assistance of the United States department of agriculture, and may employ such engineers, assistants, or other agents as may be necessary, who shall have ingress, egress and regress to land which said board may desire to survey or examine.

Section 4. The proprietors, referred to in section one, or a majority in interest either in value or area, may file a petition to the state drainage board created by section two of this act, in which they shall set forth their desire to form a drainage district under the provisions of this act, stating the proposed name of the drainage district, the necessity for the same, with a description of the proposed starting point, routes and termini of the work and a general description of the lands proposed to be affected, together with the names of known owners of said lands. And if the purpose of such owners is the repair and maintenance of a ditch or ditches or other work theretofore constructed under any law of this commonwealth, said petition shall give a general description of the same with such particulars as may be deemed important. Upon the receipt

of said petition the said state drainage board shall proceed at the expense of the commonwealth to make such surveys of the land proposed to be drained as it shall deem necessary, and shall further ascertain, by such surveys or other investigations, the need of any drainage required for the benefit of the public health, agricultural and other uses to which the land can be put after drainage, and its value for such uses after drainage, and in general the advisability of undertaking the proposed drainage or maintenance, and shall make recommendations in relation thereto, including a statement of what portion, if any, of the expense should be borne by the state on account of the cost of that part of the improvement relating to the public health; and if the state drainage board approve of the undertaking, it shall issue a certificate appointing three, five or seven commissioners, who shall be sworn to the faithful performance of their duties, and fix their compensation, which shall not exceed the sum of five dollars per day while in conference and their necessary travelling expenses while in performance of their duties, and authorize said commissioners to form a drainage district under the provisions of this act. Said commissioners or any of them may be removed by said state drainage board for cause.

Section 5. The said commissioners, hereinafter styled the drainage district commissioners, after being duly sworn, shall call by a notice signed by a majority of them a meeting of such owners of lands to be improved as are known to them, setting forth the time and place of the meeting and its purpose, notice to be given in such manner as the said drainage board may order, setting forth the time and place of the meeting and the purpose of organizing a drainage district, that is, to carry out the proposed improvements or maintenance under the provisions of sections thirteen, nineteen, twenty, twenty-one of chapter one hundred and ten of the Revised Laws.

Section 6. The said drainage district commissioners, when the certificate of the organization of the drainage district is certified and approved by the secretary of the commonwealth, shall petition the county commissioners of any county in which the greater part of the land to be improved lies, annexing a certified copy of their previous petition to the said drainage board, and of the determination of the said drainage board, and shall request the said county commissioners to vote in the first instance to pay the total expense involved in making the improvements found by the said drainage board to be for the general advantage of the proprietors, and the said county commissioners may in their discretion so vote; but after the completion of the work, the towns or cities in which any portion of the land improved may lie shall repay to the county their share of the expense, except such share of the expense as the said state drainage board shall determine should be borne by the state.

Section 7. The drainage district commissioners shall, after due notice and a hearing, and in such manner as they shall deem just and equitable, determine what proportion of the total expense incurred under this act shall be paid by any town or city, respectively, in which any of the land

mproved lies, and shall return their award into said state drainage board, and when the same has been accepted by the board it shall be a final adjudication of all matters referred to said commissioners and shall be binding on all parties, and a copy shall be sent to the county commissioners of each of the counties in which the land lies; and in like manner said drainage district commissioners shall return and file their award as to the payment of the cost of maintenance of drains and ditches, and the works or structures taken or otherwise acquired in connection therewith, and determine the proportion in which a town or city shall bear the same. The sum thus ascertained to be due from any town or city to the county shall be paid in not exceeding twenty annual instalments, and each instalment shall annually be collected as a tax from the said town or city.

Section 8. The assessors of each of the towns or cities shall annually divide and apportion the sums which their respective municipalities are required to pay upon the land benefited as hereinbefore provided, during each of the said twenty years or such part thereof as they may determine, in proportion to the benefit received, but no apportionment shall be made that exceeds the special benefit received by the estate assessed; and the said apportionment shall be added to the tax assessed upon said land, and shall constitute a lien thereon to the same extent and for the same time that taxes assessed are now a lien upon land assessed; and the payment thereof shall be enforced in the manner provided by law for the collection of ordinary taxes: *provided, however*, that any one assessed may pay the entire amount uncollected on any date when an apportionment is made. Any land, the owners or occupants of which appear by the state drainage board's return to be unknown, if the owners or occupants are unknown to the assessors of the town or city where said land is situated, shall be taxed to unknown owners, and shall be a valid tax for the non-payment of which the land may be sold for the non-payment of taxes. Any person or corporation assessed for the taxes may apply for an abatement thereof, and shall have the right and be subject to the liabilities pertaining to persons and corporations taxed under the laws of the commonwealth.

Section 9. The county in which the majority of the land improved lies shall be liable for all damages to property sustained by any person or corporation by the taking of any land easement or rights in land under authority hereof, and any such person or corporation failing to agree with said drainage district commissioners as to the amount of damages sustained may have the same determined in the manner established by law in the case of land taken for the laying out of highways, provided that application therefor is made within two years after the taking or doing of any other act herein authorized. When a certificate is filed as herein provided, the said drainage district commissioners shall within ten days thereafter notify by mail any owner or occupant, so far as they are known to said commissioners, of property taken or affected by the acts of said commissioners, and shall keep a record of such notification, which record

shall be conclusive of the fact. The certificate herein mentioned shall be signed by the chairman of the drainage district commissioners.

SECTION 10. To meet any expense incurred by a board of county commissioners under this act, said county is hereby authorized to issue scrip or a certificate of indebtedness to an amount not exceeding the entire cost. Such scrip or certificate of indebtedness shall be issued as registered bonds payable in not more than twenty years from the date of issue, and shall bear interest at a rate not exceeding five per cent per annum, payable semi-annually on the first days of January and July of each year.

SECTION 11. If any person or corporation shall obtain an additional water power or water supply in consequence of the doing of the work herein contemplated, such person or corporation shall not gain any prescriptive right to the use of such additional water power or water supply, or be entitled to any compensation therefor if such additional water power or water supply shall hereafter be taken for public use; and no person or corporation in the event of any such taking of any water power or water supply, or the removal of any dam or flashboards, or the reducing or the lowering of the height of any dam, or changing the dimensions thereof, within the limits aforesaid, shall be entitled to any compensation for such additional water power or water supply; and no person or corporation shall be allowed hereafter compensation for any increased value to his or its land or property, in case the said land or other property shall be taken for public use, if the increased value was derived directly from work done under this act.

SECTION 12. The said drainage district commissioners may take in the name of the drainage district, or acquire by purchase or otherwise, and hold all land easements and rights in land that may be necessary to effect the improvements in hand. Within thirty days after the taking of any land easement or rights in land the drainage district commissioners shall cause to be recorded in the registry of deeds for the county in which the land easement or rights in land lie a certificate thereof sufficiently accurate for identification; and thereupon title to the same shall vest in the said drainage district.

SECTION 13. The said drainage district commissioners shall make return to the county commissioners of the county in which the greater part of the land improved lies of the number of acres of land benefited by the work done or changes made under this act. The return to the assessors shall also contain the names of the owners or occupants of the lands benefited, so that they can be ascertained, and the number of acres belonging to and occupied by said owners or occupants; but the return to the assessors of any town or city need only contain the number of acres and names of owners or occupants of said land in that town or city.

SECTION 14. The drainage district commissioners shall make returns to the county commissioners of their doings and expenditures as such drainage district commissioners, and, after the approval by the county commissioners of such expenditures, shall have authority to draw upon

the treasurer of said county at proper intervals a sum not exceeding ninety per cent of the expenses incurred by the said drainage district commissioners up to the time of draft, and at the completion of said work for the balance of the amount expended.

SECTION 15. If the drainage district commissioners find that a part of the land is held by a tenant for life or years, they shall apportion and assess the expense upon the tenant and the remainderman or reversioner, unless the parties agree on an apportionment; and every such tenant, remainderman and reversioner shall be considered a proprietor.

SECTION 16. A mortgagor or mortgagee in possession shall be considered a proprietor, and all amounts paid by a mortgagee by order of the drainage district commissioners shall be allowed to him under the provisions of section twenty of chapter one hundred and eighty-seven of the Revised Laws.

SECTION 17. If the drainage district commissioners find it necessary or expedient to reduce or raise the water to obtain a view of the land, or for the more convenient or expeditious removal of obstructions, they may open the flood gates of any mill, or make other needful passages through or around the dam thereof, or erect a temporary dam on the land of a person who is not a party to the proceedings, and may maintain such dam or passages for the water as long as may be necessary for such purposes.

SECTION 18. The drainage district commissioners, before proceeding to open flood gates, or to make other passages for water through or around a dam, or to erect a dam on the land of a person who is not a party to the proceedings, shall give him reasonable notice in writing of their intention. If such person appeals from their decision and gives notice in writing of his appeal to the commissioners or to any of them, they shall suspend all proceedings upon his land until the appeal is determined, if it is entered at the return day next after the expiration of seven days from the time of claiming the same.

SECTION 19. If a party to the proceedings or a municipality or a person otherwise interested therein or affected thereby is aggrieved by any doings of the drainage district commissioners, he may enter an appeal in the court in which the petition was filed at the return day next following that at which the return of the commissioners was filed; and the court may affirm, reverse or alter any adjudication or order of the commissioners, and may make an appropriate order. Questions of fact arising upon the appeal shall, upon motion of either party, be tried by a jury in such manner as the court orders.

SECTION 20. This act shall take effect upon its passage. [*Approved June 1, 1918.*

INVESTIGATION OF SHEEP INDUSTRY AND AGRICULTURAL LAWS.

Resolves, Chapter 89.

Resolve providing for a recess commission to consider the sheep industry and related matters.

Resolved, That a recess commission consisting of three members of the senate, six members of the house of representatives and one person to be appointed by the governor with the advice and consent of the council, shall sit during the recess and consider the matter of the sheep industry in this commonwealth, and especially the message of his excellency the governor relating thereto, and shall devise methods for stimulating the production of sheep and the promotion of related interests, including agriculture; and shall study into and recommend changes in the laws affecting the organization, powers and duties of the State Department of Agriculture and other agricultural laws and agricultural organizations. The commission may give public hearings in different parts of the state, may employ a secretary and stenographer and may incur such expenses for the aforesaid purposes, and shall receive such compensation as the governor and council shall approve. The commission shall report to the next general court not later than the second Wednesday in January with such recommendations for legislation, if any, as it may deem expedient. [*Approved June 3, 1918.*

PART II. — LEGISLATION RELATING TO AGRICULTURAL EDUCATION.

REORGANIZATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

General Acts, Chapter 262.

An Act to dissolve the corporation of the Massachusetts agricultural college and to provide for the maintenance of the college by the commonwealth.

Be it enacted, etc., as follows:

Section 1. The Massachusetts Agricultural College, incorporated by chapter two hundred and twenty of the acts of eighteen hundred and sixty-three and acts in amendment thereof and in addition thereto, is hereby dissolved, and hereafter the college shall be maintained by the commonwealth as a state institution under the name of the Massachusetts Agricultural College. The commonwealth shall settle the affairs of the corporation, and shall be subject to its legal obligations and liable for its lawful debts.

Section 2. The present trustees of the said corporation shall be the trustees of the state institution, and shall hold office as such until the expiration of the several terms for which they were appointed, unless

sooner removed. The power of appointment of their successors and the power of removal of trustees shall be exercised by the governor with the advice and consent of the council. An appointment to fill a vacancy occurring prior to the expiration of the term of a trustee shall be for the unexpired part of the term, and all other appointments shall be for the term of seven years. The governor, the commissioner of education, the secretary of the state board of agriculture, and the president of the faculty of the college shall be, ex-officiis, members of the board of trustees. The number of appointive trustees shall never exceed fourteen.

Section 3. The powers and duties heretofore conferred and imposed upon the trustees of the Massachusetts Agricultural College, are hereby conferred and imposed upon the trustees of the state institution, the Massachusetts Agricultural College, who shall manage and administer any grant or devise of land, and any gift or bequest of money or other personal property, made to the commonwealth for the use of said institution, and shall carry out said trusts, and shall invest the proceeds thereof in notes or bonds secured by good and sufficient mortgages or other securities. All property now held by the corporation, the Massachusetts Agricultural College, upon special trusts shall be managed and administered by said trustees in behalf of the commonwealth in accordance with the provisions of such special trusts.

Section 4. All expenditures for the maintenance of the institution shall be authorized by a majority of the trustees, or by a majority of a duly appointed committee of the trustees. Complete records and files of the pay rolls and bills shall be kept in the office of the treasurer. A complete accounting of all receipts and expenditures of the institution from all sources shall be made by the trustees to the governor annually. There shall be a complete audit of the accounts of the institution, including all receipts and expenditures, under the direction of the trustees at least twice a year, and also under the direction of the auditor of the commonwealth, whenever he may deem it proper. Monthly statements of receipts and expenditures shall be rendered by the treasurer to the auditor. The expenditure of special appropriations shall be under the direction and control of the trustees, and shall be accounted for in the same manner as appropriations for maintenance.

Section 5. All employees of the institution shall be considered state employees, but shall not be subject to the civil service laws and regulations.

Section 6. All acts and parts of acts which apply to the present Massachusetts Agricultural College shall continue in force and apply to the Massachusetts Agricultural College hereby created so far as they are not inconsistent with this act.

Section 7. This act shall take effect upon its passage. [*Approved May 31, 1918.*

COUNTY AID TO AGRICULTURE.

General Acts, Chapter 273.

An Act to provide for the appointment in certain counties of trustees for county aid to agriculture.

Be it enacted, etc., as follows:

Section 1. In each county, except Suffolk and except counties maintaining vocational agricultural schools, the county commissioners shall, on or before the first day of October, nineteen hundred and eighteen, appoint an unpaid board of nine trustees to be known as trustees for county aid to agriculture, three of whom shall serve for one year, three for two years, and three for three years from the first day of April in the current year, and thereafter, as the term of each trustee expires, or as a vacancy occurs, the county commissioners shall appoint a successor for a term of three years from the first day of April in the year of the appointment, or for the unexpired term. All of said trustees shall be residents of the county in which they are appointed, and four, so far as possible shall be taken from the directors, chosen as hereinafter provided, of such cities or towns as have appropriated funds toward carrying out the provisions of this act. Choice of the aforesaid directors shall be made in such towns at the annual town meeting at which the appropriation is made, or at the next succeeding annual meeting whenever the appropriation is made at a special meeting, and in such cities, by the mayor and aldermen, or body exercising similar powers, not later than fifteen days following the vote authorizing the appropriation. The said directors shall serve for such terms as the appointing authority in cities and the voters in towns shall determine.

Section 2. The trustees may on behalf of the county, receive and apply to the purposes of this act money appropriated therefor by any county, city or town, or by the federal government, and may control the expenditure thereof either solely or in conjunction with representatives or agents of the commonwealth or of the United States, or of any department, commission, board or institution created under the statutes of the commonwealth or under an act of congress. The trustees may enter into agreements, arrangements or undertakings with any such departments, commissions, boards and institutions, relative to extension work with adults and with boys and girls in agriculture, home-making and country life.

Section 3. The said trustees shall maintain one or more agents or instructors in agriculture, home-making and country life, who shall meet the residents of the county individually and in groups for the purpose of teaching and demonstrating better practice in agriculture and home-making, the benefits to be derived from cooperative efforts, better methods of marketing farm products and the organization of communities to build up country life.

Section 4. The trustees shall annually prepare a budget, and submit the same to the county commissioners not later than the last Wednesday in December, containing a detailed estimate of all sums required by them for carrying out the purposes of this act during the ensuing year. The county commissioners shall include in their annual estimate of county expenses to be appropriated by the general court and raised by the annual county tax levy such sums as they may deem necessary to meet one half of the requirements of the trustees during said year: provided that county funds shall be paid to the said trustees to the extent only and upon their certificate that a like amount has been received by them from other sources, including funds received under the provisions of section two.

Section 5. Any city or town may in the manner in which land may be acquired for school purposes, acquire, by purchase or otherwise, real estate for the purpose of carrying on, under the direction of the agents or instructors of said trustees, demonstration work in agriculture and home-making, and may, in the manner provided by law for making appropriations for municipal purposes, appropriate money to be expended by said trustees for the purposes of this act, or for the purpose of enabling the trustees to acquire necessary real estate, or for the support of demonstration work, under the direction of the agents or instructors or of the trustees, on land owned by the city or town or by any resident thereof.

Section 6. Chapter seven hundred and seven of the acts of nineteen hundred and fourteen is hereby repealed.

Section 7. This act shall take effect upon its passage. [*Approved May 31, 1918.*

APPROPRIATION FOR IMPROVEMENTS AT THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Resolves, Chapter 69.

Resolve providing for certain improvements and equipment at the Massachusetts Agricultural College.

Resolved, That there be allowed and paid out of the treasury of the commonwealth, to be expended at the Massachusetts Agricultural College under the direction of the board of trustees, a sum not exceeding eighty-six thousand five hundred dollars for the following purposes: — For improvements at the power plant, including coal handling apparatus, turbine house and equipment, a sum not exceeding fifty-four thousand five hundred dollars; for improvements in the dining hall, a sum not exceeding twelve thousand dollars; and for miscellaneous improvements in buildings and grounds, miscellaneous teaching, operating and office equipment for the farm, gardens, experiment station, and teaching departments, a sum not exceeding twenty thousand dollars. [*Approved May 29, 1918.*

APPROPRIATION FOR IMPROVEMENTS AND MAINTENANCE AT THE MARKET GARDEN FIELD STATION.

Resolves, Chapter 56.

Resolve providing for maintenance and improvements at the market garden field station in Lexington.

Resolved, That there be allowed and paid out of the treasury of the commonwealth from the ordinary revenue, to be expended by the trustees of the Massachusetts Agricultural College at the market garden field station in Lexington, a sum not exceeding sixteen thousand five hundred dollars for the following purposes: For greenhouses and heating plant, nine thousand dollars; for a foreman's cottage, four thousand five hundred dollars; for maintenance, three thousand dollars. [*Approved May 14, 1918.*

ESTABLISHMENT OF SMITH'S AGRICULTURAL SCHOOL.

Special Acts, Chapter 151.

An Act establishing smith's agricultural school.

Be it enacted, etc., as follows:

Section 1. The city of Northampton is hereby authorized through Smith's Agricultural School and Northampton School of Industries, heretofore established in and by the said city, to carry out the provisions of the will of Oliver Smith, late of Hatfield, relative to the establishment of Smith's Agricultural School, which provisions were duly accepted by vote of the town of Northampton passed on the thirtieth day of October in the year eighteen hundred and forty-seven, and to appropriate money for the support and maintenance of the said school, which shall hereafter be called Smith's Agricultural School.

Section 2. The city of Northampton shall annually at its city election elect by ballot, as provided in said will, three superintendents who shall have the powers of a local board of trustees as provided in section four of chapter four hundred and seventy-one of the acts of nineteen hundred and eleven. The election of superintendents heretofore made is ratified and confirmed.

Section 3. In computing the net maintenance sum for the said school for purposes of state reimbursement under clause one of section nine of said chapter four hundred and seventy-one, there shall be added to the sum raised by local taxation the sum annually received by the city of Northampton from the Smith charities and expended for the maintenance of the school.

Section 4. This act shall take effect upon its passage. [*Approved May 10, 1918.*

Note. — Chapters 262 and 273 of the General Acts and chapter 151 of the Special Acts, *supra*, were passed in order to bring the Agricultural College, the County Farm Bureaus and Smith's Agricultural School into conformity with the amendment to Article XVIII. of the Constitution of Massachusetts, adopted by the voters in November, 1917, and known as the Anti-Aid Amendment.

PART III. — GENERAL AGRICULTURAL LEGISLATION.

GRADING OF MILK.

General Acts, Chapter 170.

An Act relative to the classification and grading of milk.

Be it enacted, etc., as follows:

Section three of chapter two hundred and fifty-six of the General Acts of nineteen hundred and seventeen is hereby amended by striking out the word "two", in the sixth line, and substituting the word: — one, — so as to read as follows: — *Section 3.* The board of health of any city or town, upon application of any person, firm, association or corporation, desiring to sell or exchange milk therein as "Grade A, Massachusetts Milk", shall cause the milk produced or to be sold or exchanged by such applicant to be tested for classification as prescribed by section one of this act, and if upon such examination and test the milk so produced or to be sold or exchanged by the applicant is found to comply with the aforesaid requirements of classification of "Grade A, Massachusetts Milk", the board of health shall issue without charge to the applicant a written permit to keep for sale, exchange or delivery, or to sell, exchange or deliver in such city or town, milk graded, classified, designated and labelled, as hereinbefore provided, as "Grade A, Massachusetts Milk". Any permit so issued may, at any time, be revoked upon written notice to the holder thereof, by the board of health issuing the same, if milk offered by the holder for sale or exchange as so graded or classified shall not comply with the aforesaid requirements. [*Approved April 24, 1918.*

COMMERCIAL FERTILIZERS.

General Acts, Chapter 220.

An Act relative to the sale of commercial fertilizers.

Be it enacted, etc., as follows:

Section 1. Chapter three hundred and eighty-eight of the acts of nineteen hundred and eleven is hereby amended by striking out section six, and substituting the following: — *Section 6.* When the certified copy of the label of any brand of fertilizer has been filed, and the proper fees have been paid, the director of the Massachusetts agricultural experiment station shall issue or cause to be issued a certificate to that effect; and the certificate shall be deemed to authorize the sale in this commonwealth, in compliance with this act, of the brand of fertilizer for which the certificate is issued up to and including the thirty-first day of December of the year for which it is issued. The director of the Massachusetts agricultural experiment station or his authorized deputy may refuse to issue a certificate for any fertilizer or brand of fertilizer which does not contain at least one half of one per cent of nitrogen, or one half of one per cent of

potash soluble in distilled water, or one per cent of phosphoric acid, or five per cent of lime, or five per cent of magnesia, or which contains its potash or phosphoric acid or lime or magnesia in forms substantially insoluble by the methods of analysis for commercial fertilizers prescribed by the Association of Official Agricultural Chemists of North America, or which does not possess substantial properties as a fertilizer. The said director or his deputy may also refuse to issue a certificate for any fertilizer under a name, brand, or trade mark which is untrue in any particular, or which, in his opinion, would be misleading or deceptive in any particular, or would tend to mislead or deceive as to the constituents or properties of said fertilizer. The director or his deputy may refuse to issue more than one certificate for any fertilizer under the same name or brand, or to issue a certificate for any fertilizer under a name or brand to the use of which the party is not lawfully entitled. Should a certificate be issued for any fertilizer and it be discovered afterward that the certificate itself, or the granting of it, or the manner of procuring it, was in any respect in violation of any provision of this act, the said director and his authorized deputy, shall have power to cancel the certificate. No commercial fertilizer or brand of fertilizer shall be sold or offered or exposed for sale until a certificate has been issued by the director or his authorized deputy, and any manufacturer, importer, or other person who shall sell, or offer or expose for sale a fertilizer or brand of fertilizer for which no certificate has been issued, or the certificate for which has been cancelled, shall be punished by a fine not exceeding two hundred dollars for each offence.

Section 2. Section nine of chapter three hundred and eighty-eight of the acts of nineteen hundred and eleven is hereby amended by inserting after the word "with", in the tenth line, the words: — he may prescribe and enforce such rules and regulations relative to the sale of commercial fertilizers as he may deem necessary to carry into effect the full intent and meaning of this act, — so as to read as follows: — *Section 9.* Any person hindering or obstructing the director of the Massachusetts agricultural experiment station, or any inspector or deputy of the said director, in the discharge of the authority or duty conferred or imposed by any provision of this act and any person violating any provision of sections one, two, three, four and five of this act shall be fined not less than fifty dollars and not more than two hundred dollars for each offence. It shall be the duty of the said director to see that the provisions of this act are complied with, he may prescribe and enforce such rules and regulations relative to the sale of commercial fertilizers as he may deem necessary to carry into effect the full intent and meaning of this act and he may, in his discretion, prosecute or cause to be prosecuted any person violating any provision of this act. But no complaint based upon an analysis of samples shall be made for any such violation, if the samples were taken otherwise than as provided in this act. And no complaint shall be made for a failure of any fertilizer or brand of fertilizer to meet the guaranteed

analysis thereof if the analysis of such fertilizer made by the director, or by his deputy or deputies, shows the amounts of the constituents thereof to be substantially equivalent to the percentages stated in the label of the fertilizer.

SECTION 3. In addition to the requirements of section five of chapter three hundred and eighty-eight of the acts of nineteen hundred and eleven, every manufacturer, importer or other person who sells or offers or exposes for sale in this commonwealth any commercial fertilizer shall, on or before the first day of January and July in each year, beginning with January, nineteen hundred and nineteen, file with the director of the Massachusetts agricultural experiment station a sworn statement in such form as the director may prescribe setting forth the number of net tons of fertilizer sold by him in the commonwealth during the preceding six months, stating in each case the number of tons of every brand sold, together with a permit allowing the director or his authorized deputy to examine the books of the person filing the statement, for the purpose of verifying the same, and shall thereupon pay to the director a fee of six cents a ton of two thousand pounds for the fertilizers so sold, except that no such statement, permit or fee shall be required in respect of agricultural lime. The said director or his authorized deputy shall have power to cancel the certificate for any brand of fertilizer in respect to which the requirements of this section have not been complied with, and any manufacturer, importer or other person who shall sell or offer or expose for sale in this commonwealth a fertilizer or brand of fertilizer without having filed the statement and permit and paid the fee required by this section shall be punished by a fine not exceeding five hundred dollars for each offence. But no agent or other person shall be obliged to file a statement or permit, or pay the fee required by this section, for any brand of fertilizer for which the statement and permit have been filed and for which the fee has been paid by the manufacturer or importer of such brand. The director is hereby authorized and it is made his duty to collect the fee required by this section, and to turn over the same to be accounted for and disbursed in accordance with the provisions of section ten of said chapter three hundred and eighty-eight. [*Approved May 21, 1918.*

REQUARANTINING OF ANIMALS.

GENERAL ACTS, CHAPTER 39.

AN ACT RELATIVE TO THE REQUARANTINING OF ANIMALS WHICH HAVE BEEN RELEASED FROM QUARANTINE.

Be it enacted, etc., as follows:

SECTION 1. Section twenty-five of chapter ninety of the Revised Laws is hereby amended by striking out the words "board of cattle commissioners or of any of its members or agents", in the second and third lines, and substituting the words: — commissioner of animal industry or of his

agent, — by inserting after the word "disease", in the fifth line, the words: — Whenever an animal has been released from quarantine by order of the commissioner the same animal shall not again be quarantined or isolated by an inspector of animals during the period of thirty days immediately following such release except upon order of the commissioner, — by striking out the words "board of cattle commissioners", in the twenty-third line, and substituting the words: — commissioner of animal industry, — and by striking out the word "its", in the twenty-fourth line, and substituting the word: — his, — so as to read as follows: — *Section 25.* An animal which has been quarantined or isolated by order of the commissioner of animal industry or of his agent, or of an inspector, shall, during the continuance of such quarantine or isolation, be deemed to be affected with a contagious disease. Whenever an animal has been released from quarantine by order of the commissioner the same animal shall not again be quarantined or isolated by an inspector of animals during the period of thirty days immediately following such release except upon order of the commissioner. Whoever knowingly breaks or authorizes or causes to be broken a quarantine so imposed, or whoever, contrary to such order of quarantine or isolation, knowingly removes an animal or authorizes or causes it to be removed from a building, place or enclosure where it is quarantined or isolated, or whoever, contrary to an order or notice of quarantine, knowingly places or causes or authorizes to be placed any other animal or animals within a building, place or enclosure where an animal is quarantined, or in contact therewith, or whoever knowingly conceals, sells, removes or transports, or knowingly causes or authorizes to be concealed, sold, removed or transported, an animal, knowing or having reasonable cause to believe that it is affected with a contagious disease, or whoever knowingly authorizes or permits such animal to go at large upon any public way within this commonwealth, or whoever knowingly brings or authorizes or permits to be brought from another country, state, district or territory into this commonwealth, an animal which is affected with or has been exposed to a contagious disease, or whoever disobeys a lawful order or regulation of the commissioner of animal industry or of any of his agents or inspectors in the performance of their duty under the provisions of this chapter, shall be punished by a fine of not more than five hundred dollars or by imprisonment for not more than one year, or by both such fine and imprisonment.

Section 2. This act shall take effect upon its passage. [*Approved March 1, 1918.*

CONTAGIOUS DISEASES OF ANIMALS.

General Acts, Chapter 209.

An Act relative to the definition of contagious diseases of domestic animals.

Be it enacted, etc., as follows:

Section 1. Section twenty-eight of chapter ninety of the Revised Laws, as amended by section one of chapter six of the acts of nineteen hundred and eleven, is hereby further amended by striking out the said section and inserting in place thereof the following: — *Section 28.* Contagious diseases, under the provisions of this chapter, shall include such diseases as are recognized by the United States bureau of animal industry to be contagious or infectious.

Section 2. This act shall take effect upon its passage. [*Approved May 15, 1918.*

PRISON LABOR FOR AGRICULTURAL PURPOSES.

General Acts, Chapter 159.

An Act relative to the labor of prisoners on land used for agricultural or domestic purposes.

Be it enacted, etc., as follows:

Section two of chapter six hundred and thirty-three of the acts of nineteen hundred and thirteen, as amended by chapter one hundred and eighty of the acts of nineteen hundred and fourteen, and by chapter one hundred and seventy-seven of the General Acts of nineteen hundred and fifteen, is hereby further amended by inserting after the word "land", in the tenth line, the words: — , or land used for agricultural or domestic purposes, — so as to read as follows: — *Section 2.* The county commissioners of any county may purchase or lease land with funds specifically appropriated therefor by the general court for the purpose of improving and cultivating it by the labor of prisoners from a jail or house of correction; and the said commissioners may also make arrangements with the Massachusetts highway commission or with the officials of a city or town to work said prisoners on any highway or unimproved land, or with a private owner, to improve waste or unused land, or land used for agricultural or domestic purposes, by means of such prison labor. When prisoners are so employed they shall be in the custody of the sheriff of the county. When land that is not the property of the county, or is a highway, is so improved, the owners thereof or those having in charge the highway shall pay to the county such sums as may be agreed upon between the county commissioners, sheriff, and the other parties in interest, for the labor of any prisoners employed thereon. [*Approved April 20, 1918.*

DOG OFFICERS.

General Acts, Chapter 271.

An Act relative to the appointment of certain dog officers by county commissioners.

Be it enacted, etc., as follows:

Section 1. Section one hundred and fifty-five of chapter one hundred and two of the Revised Laws, as amended by section one of chapter one hundred and forty-two of the acts of nineteen hundred and four, by chapter two hundred and forty-one of the acts of nineteen hundred and seven, and by section one of chapter three hundred and ninety-two of the acts of nineteen hundred and ten, is hereby further amended by striking out the said section and substituting the following: — *Section 155.* The county commissioners, except in the county of Suffolk, shall appoint one and may appoint not more than four suitable persons, all residents of the county, any one of whom shall, at the request of said commissioners, or of the chairman of the selectmen of a town or officer of the police designated as provided in section one hundred and fifty-one, investigate any case of damages done by a dog of which the commissioners, chairman or officer shall have been informed as provided in said section, and if he believes that the evidence is sufficient to sustain an action against the owner or keeper of the dog as provided in section one hundred and sixty-two and believes that such owner or keeper is able to satisfy any judgment which may be recovered in such action, he shall, unless the owner or keeper before action brought pays him such amount in settlement of the damage as he deems reasonable, bring the action. It may be brought in his own name and in the county in which he resides, and he shall prosecute it. Said officers shall also have throughout their respective counties the same powers and authority as police officers or constables acting under the provisions of section one hundred and forty-three. All damages received or recovered under this section shall be paid over to the county treasurer and placed to the credit of the dog fund. The county treasurer shall pay out of the dog fund such reasonable compensation as the county commissioners shall allow for services and necessary expenses under this section and the reasonable expense of prosecuting the said actions. The person or persons appointed hereunder may be removed at any time by the county commissioners, and in counties in which they are appointed the county treasurer shall not be authorized to bring the said actions.

Section 2. This act shall take effect upon its passage. [*Approved May 31, 1918.*

APPROPRIATIONS FOR STIMULATION OF FOOD PRODUCTION.

RESOLVES, CHAPTER 63.

AN ACT TO PROVIDE FOR PROMOTING AND STIMULATING THE PRODUCTION AND CONSERVATION OF FOOD PRODUCTS.

Be it enacted, etc., as follows:

SECTION 1. There shall be allowed and paid out of the treasury of the commonwealth a sum not exceeding two hundred thousand dollars, to be expended under the direction of the governor and council, for the purpose of promoting and stimulating the production and conservation of food products, and for like purposes growing out of the present war emergency.

SECTION 2. This act shall take effect upon its passage. [*Approved March 1, 1918.*

RESOLVES, CHAPTER 139.

AN ACT TO MAKE FURTHER PROVISION FOR STIMULATING THE PRODUCTION AND CONSERVATION OF FOOD PRODUCTS.

Be it enacted, etc., as follows:

SECTION 1. There shall be allowed and paid out of the treasury of the commonwealth a sum not exceeding one hundred thousand dollars, to be expended under the direction of the governor and council for the purpose of promoting and stimulating the production and conservation of food products, and for like purposes growing out of the present war emergency, the same to be in addition to the amount authorized by chapter sixty-three of the Special Acts of the present year.

SECTION 2. This act shall take effect upon its passage. [*Approved April 24, 1918.*

The Commonwealth of Massachusetts

STATE BOARD OF AGRICULTURE

ROOM 136, STATE HOUSE, BOSTON

WILFRID WHEELER, Secretary

LIST OF AVAILABLE PUBLICATIONS

APRIL, 1918

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
32 DERNE STREET.
1918.

Publication of this Document
approved by the
Supervisor of Administration.

LIST OF AVAILABLE PUBLICATIONS.

The following list gives the title, and in most cases the author and date, of all publications of the Massachusetts State Board of Agriculture available, or in press, on April 1, 1918.

Copies of bulletins, circulars, separates and nature leaflets will be mailed to any applicant free of charge. The expense of shipping the annual and special reports must be borne by the applicant. The special reports are sold at cost of preparing, printing and binding.

New information is constantly accumulating and being published as time for proper editing and appropriations permit. In most instances before being reprinted articles are submitted to the author for additions and corrections, and are thus kept thoroughly up to date.

From time to time our supply of certain publications is exhausted. Failure to enclose any publication requested may be taken as notice that such publication cannot be supplied. Publications which have been issued since the last "List of Available Publications" are in bold-faced type.

BULLETINS OF MASSACHUSETTS AGRICULTURE.

Free, postpaid, on request. Order by number.

1. "Poultry Culture." Fifth edition, revised. Illustrated. September, 1917.
2. "Apple Growing." Fifth edition, revised. Illustrated. November, 1916.
3. "Grasses and Forage Crops." Second edition, revised. Illustrated. April, 1915.
5. "Vegetable Growing." Third edition, revised. Illustrated. April, 1918.

APIARY INSPECTION BULLETINS.

Free, postpaid, on request. Order by number.

5. "Some of the Essentials of Bee Keeping," by Burton N. Gates. Third edition, 1918.
7A. "Soft Candy Feed for Bees," by Burton N. Gates, 1913. Illustrated.
11. Annual report of the State Inspector of Apiaries for the year 1917.

NURSERY INSPECTION BULLETINS.

Free, postpaid, on request.

3. **Digest of Laws governing Shipments of Nursery Stock,** R. H. Allen. First edition, September, 1917.

Annual report of the State Nursery Inspector for the year 1917.

Colored plates showing stages of white pine blister rust. (Annual reports of the State Nursery Inspector for 1913, 1915 and 1916 are also available. The latter contains a list of nurserymen in Massachusetts.

DAIRY BUREAU PUBLICATIONS.

Free, postpaid, on request. Order by letter. These leaflets will be sent in quantities to milk producers, dealers or other parties.

A. Illustrated folder on the "Food Value of Milk" has been substituted for this leaflet.

B. "Milk: Its Cost and Consumption," by P. M. Harwood, February, 1914.

C. "Milk: Its Treatment," by P. M. Harwood, March, 1914.

D. "Milk: Importance of Cleanliness and Freshness," by P. M. Harwood, April, 1914.

E. "**Milk: United States Department of Agriculture Quotations on Comparative Value of Muscle-building and Energy-producing Material in Milk with that in Sirloin Steak and Eggs,**" by P. M. Harwood, April, 1918.

F. "**Milk: Advice to Dairymen,**" by P. M. Harwood, April, 1918.

G. "**Milk: Food Value of Skim Milk,**" by P. M. Harwood, April, 1918.

H. "**Milk: Food Value of Cottage Cheese,**" by P. M. Harwood, February, 1918.

I. "**Milk: Comparative Costs of Feeds,**" by P. M. Harwood, September, 1917.

J. "**Milk: Comparison of Butter with its Imitations,**" by P. M. Harwood, April, 1918.

K. "**Milk: Uses of Cream and Illustrations of the Growth-promoting Factor in Milk Fat,**" by P. M. Harwood, April, 1918.

L. "**Milk: Food Value of American Cheddar Cheese and Suggested Uses,**" by P. M. Harwood, February, 1918.

M. "**Milk: Quotations from Eminent Authorities,**" by P. M. Harwood, February, 1918.

N. "**Milk: Giving the Scientific Proof of what Every Farmer knows,**" by P. M. Harwood, April, 1918.

O. "**Milk: Graphic Illustration of its Food Value,**" by P. M. Harwood, April, 1918.

P. "**Milk: The Dependency of the World upon the Support of Milk Production,**" by P. M. Harwood, April, 1918.

Q. "**Milk: The Wonderful Productive Capacity of the Dairy Cow,**" by P. M. Harwood, April, 1918.

R. "**Milk: The Necessity of using Milk and Milk Products with Bread,**" by P. M. Harwood, April, 1918.
"Rules for Care of Milk in the Home," by P. M. Harwood, October, 1916.
Report of 1915, Encouragement of Dairying Contests.
Report of 1916, Encouragement of Dairying Contests.
Report of 1917, Encouragement of Dairying Contests.
Annual report of the Dairy Bureau for the year 1917.

BULLETINS OF ECONOMIC BIOLOGY.

Free, postpaid, on request. Order by number.

2. "The Domestic Cat, Bird Killer, Mouser and Destroyer of Wild Life," by Edward Howe Forbush. Illustrated. February, 1916.

CIRCULARS.

Free, postpaid, on request. Available in quantities to organizations and individuals that can place them in the hands of persons who may be benefited thereby. Numbers which are omitted are out of print.

2. "Insecticides, Fungicides, and Directions for their Use," by H. T. Fernald, 1913. Illustrated.
3. "Balanced Rations for Dairy Stock," by J. B. Lindsey, 1913.
5. "Pork Making for Massachusetts Farmers," by George M. Twitchell. Second edition, January, 1917.
6. "Three Common Scale Insects," by H. T. Fernald, August, 1913. Illustrated.
9. "What it Costs to Produce Milk in New England," by P. M. Harwood. Second edition, December, 1914.
11. "Some Bacteriological Aspects of Clean Milk Inspection," by Charles E. Marshall, December, 1913.
14. "The Culture of the Currant," by U. P. Hedrick. (From "Agriculture of Massachusetts, 1913.")
15. "Cantaloupe Growing in Massachusetts," by J. M. S. Leach. (From "Agriculture of Massachusetts, 1913.")
19. "The New Orchard," by Fred C. Sears. Illustrated. (From "Agriculture of Massachusetts, 1913.")
20. "Farm Management," by G. F. Warren. (From "Agriculture of Massachusetts, 1913.")
22. "The Army Worm," by H. T. Fernald. Illustrated. (From "Agriculture of Massachusetts, 1914.")
23. "Rural Credit, Banking and Agricultural Co-operation in Europe," by J. Lewis Ellsworth. (From "Agriculture of Massachusetts, 1913.")
24. "Alfalfa Growing," by Joseph Wing. (From "Agriculture of Massachusetts, 1913.")
26. "Nut Culture for Massachusetts," by William C. Deming. (From "Agriculture of Massachusetts, 1913.")

30. "Farm Ice Houses," by B. S. Pickett. Illustrated. (From "Agriculture of Massachusetts, 1913.")
31. "The Farmers' Interest in Game Protection," by E. H. Forbush. Second edition, revised. February, 1915.
34. "Household Accounting," by Laura Comstock. (From "Agriculture of Massachusetts, 1914.")
35. "Alfalfa for New England," by Arthur D. Cromwell. (From "Agriculture of Massachusetts, 1914.")
36. "Factors Affecting Economical Milk Production," by C. H. Eckles. (From "Agriculture of Massachusetts, 1914.")
37. "The Value of Experimental Work for Truck Farmers," by T. C. Johnson. (From "Agriculture of Massachusetts, 1914.")
39. "A Practical System of Farm Accounting," by Charlotte P. Goddard. (From "Agriculture of Massachusetts, 1914.")
40. "Co-operation in Fruit Growing as Practiced in Nova Scotia," by W. H. Woodworth. (From "Agriculture of Massachusetts, 1914.")
41. "Cranberry Growing," by Henry J. Franklin. (From "Agriculture of Massachusetts, 1914.") Second edition.
42. "The Home Vegetable Garden," by Allen French. Illustrated. (From "Agriculture of Massachusetts, 1914.") Third edition, February, 1918.
43. "Sewage Disposal in Rural Districts," by Edward H. Williams. Illustrated. (From "Agriculture of Massachusetts, 1914.")
44. "The Sanitary Side of Farm Water Supplies," by X. H. Goodnough. (From "Agriculture of Massachusetts, 1914.")
45. "The Starling," by Edward Howe Forbush. Illustrated. (From "Agriculture of Massachusetts, 1910.") Second edition, revised. February, 1916.
46. "The Tent Caterpillar," by H. T. Fernald, 1915. Illustrated.
47. "Bird Houses and Nesting Boxes," by Edward Howe Forbush. Illustrated. (From "Agriculture of Massachusetts, 1915.") Second edition, revised. February, 1917.
50. "Apple Grading and Packing," by Wilfrid Wheeler and H. Linwood White. (An explanation of the Massachusetts Apple Grading Law.) Second edition, revised. July, 1917. (Also Supplement A to Cir. 50).
51. "Tobacco Growing in the Connecticut River Valley," by Leslie R. Smith. Illustrated. (From "Agriculture of Massachusetts, 1915.")
52. "Onion Growing in the Connecticut River Valley," by Leslie R. Smith. Illustrated. (From "Agriculture of Massachusetts, 1915.")
54. "Standardization of Farm Products," by Charles McCarthy. (From "Agriculture of Massachusetts, 1915.")
55. "Canning in Glass in the Home," by Sarah Elizabeth Belt. (From "Agriculture of Massachusetts, 1915.") Fourth edition, revised. August, 1917.
56. "Farm Management: its Application to Southern New England," by Junius S. Cates. (From "Agriculture of Massachusetts, 1915.")

57. "Milk Inspection from the Producers' Standpoint," by Harvey W. Wiley, M.D. (From "Agriculture of Massachusetts, 1915.")
58. "Utilization of Surplus Farm Products," by H. F. Hall. (From "Agriculture of Massachusetts, 1915.")
59. "Rural Credits — their Object," by Myron T. Herrick. (From "Agriculture of Massachusetts, 1915.")
60. "Alfalfa Conditions in New England," by H. W. Jeffers. (From "Agriculture of Massachusetts, 1915.")
61. "Grading Milk as a Substitute for Dairy Inspection," by Charles E. North, M.D. (From "Agriculture of Massachusetts, 1915.")
62. "Domestic Science Teaching in Rural Districts," by Sarah Tyson Rorer. (From "Agriculture of Massachusetts, 1915.)
63. "The Improvement of Live Stock," by R. W. Hayne. (From "Agriculture of Massachusetts, 1916.")
64. "Breeding and Selecting Fowls for Egg Production," by James E. Rice. (From "Agriculture of Massachusetts, 1916.")
65. "The Maintenance of Soil Fertility," by Charles E. Thorne. (From "Agriculture of Massachusetts, 1916.")
66. "Advertising Agricultural Products," by Henry K. Hannah. (From "Agriculture of Massachusetts, 1916.")
67. "Market Gardening," by R. H. Garrahan. (From "Agriculture of Massachusetts, 1916.")
68. "Pasteurization of Market Milk," by O. F. Hunziker. (From "Agriculture of Massachusetts, 1916.")
69. "Co-operative Dairying," by E. S. Brigham. Illustrated. (From "Agriculture of Massachusetts, 1916.")
70. "Marketing Milk and Cream," by E. L. Bradford. (From "Agriculture of Massachusetts, 1916.")
71. "The Oxford Bears Fruit Growers' Association," by E. E. Conant. (From "Agriculture of Massachusetts, 1916.")
72. "Business Organization as related to Agriculture," by Marcus L. Urann. (From "Agriculture of Massachusetts, 1916.")
73. "**Potato Growing in Massachusetts,**" by S. C. Damon, May, 1917.
74. "**Common Potato Diseases and their Control,**" by A. Vincent Osmun. (From "Agriculture of Massachusetts, 1917.")
75. "**Common Storage of Fruits and Vegetables,**" by Edward Howe Forbush. (From "Agriculture of Massachusetts, 1917.")
76. "**The Value of a Market News Service to Farmers and Fruit Growers,**" by Howard W. Selby. (From "Agriculture of Massachusetts, 1917.")
77. "**The Work of the Federal Land Bank,**" by Leonard G. Robinson. (From "Agriculture of Massachusetts, 1917.")
78. "**Short-Time Credit for Farmers,**" by Charles P. Holland. (From "Agriculture of Massachusetts, 1917.")
79. "**What Organization has done for the Milk Business,**" by Richard Pattee. (From "Agriculture of Massachusetts, 1917.")

80. "**The Significance of a Kernel of Corn,**" by George M. Twitchell. (From "Agriculture of Massachusetts, 1917.")
81. "**The Importance of Honey Production,**" by E. R. Root. (From "Agriculture of Massachusetts, 1917.")
82. "**The Relation of the Railroad to the Farmer,**" by George A. Cullen. (From "Agriculture of Massachusetts, 1917.")
83. "**Directions for Growing Small Grains,**" by Wilfrid Wheeler, March, 1918.
84. "**Public Markets in Massachusetts,**" by R. Edwards Annin, Jr., March, 1918.

ANNUAL REPORTS, "AGRICULTURE OF MASSACHUSETTS."

The volumes entitled "Agriculture of Massachusetts" contain the annual report of the secretary, the Dairy Bureau, Nursery Inspector, Inspector of Apiaries, Ornithologist, supervisor of boys' and girls' club work, a directory of the agricultural organizations in the State, the returns of the agricultural societies, together with the addresses before the Board at its Public Winter Meeting, and some of the articles which have been published throughout the year. For example, "The Significance of a Kernel of Corn," by George M. Twitchell, appears as Circular No. 80, and also in "Agriculture of Massachusetts, 1917." It is suggested, therefore, that applicants wishing the complete annual report for any year do not apply for the circulars contained therein. Beginning with the year 1915, the volume "Agriculture of Massachusetts" is published in two parts. Part I. contains the routine reports and Part II. the addresses at the Public Winter Meeting. The 1917 volumes will appear about June 1.

Back numbers of the annual reports are also available for distribution. These volumes are free, on request at the office of the Board. They will be sent by express, charges collect, or by parcel post, on receipt of necessary postage. The weight of these books for mailing purposes is 3 pounds, and postage to any office in Massachusetts is 7 cents. For postage to more distant points, see parcel-post manuals or inquire at local post office.

SPECIAL REPORTS.

"Useful Birds and their Protection," by Edward Howe Forbush, State Ornithologist. Fourth edition, revised and enlarged. November, 1913.

A book of 451 pages, bound in red cloth, and illustrated by a colored frontispiece, 60 plates and 171 figures in the text.

Contains brief descriptions of the more common and useful species of Massachusetts, with accounts of their food habits, and a chapter on the means of attracting and protecting birds.

Price, $1.25. The weight of this book for mailing purposes is 5 pounds, and it may be sent by parcel post, on receipt of necessary postage, or express collect, at option of purchaser. Make checks and money orders payable to Wilfrid Wheeler, Secretary, State Board of Agriculture. Postage to any point in Massachusetts, Rhode Island, Connecticut and southern Vermont and New Hampshire is 9 cents.

"A History of the Game Birds, Wild Fowl and Shore Birds of Massachusetts and Adjacent States," by Edward Howe Forbush, State Ornithologist. Second edition, revised and enlarged. March, 1916.

A book of 636 pages, bound in green cloth, and illustrated by a colored frontispiece, 36 plates, 82 cuts and 26 figures in the text.

Consists of: Part I. — A history of the birds now hunted for food or sport in Massachusetts and adjacent States; Part II. — A history of the game birds and other birds hunted for food or sport which have been driven out of Massachusetts and adjacent States, or exterminated since the settlement of the country; Part III. — The conservation of game birds, wild fowl and shore birds.

Price, $1.25. The weight of this book for mailing purposes is 5 pounds, and it may be sent by parcel post, on receipt of necessary postage, or by express collect, at option of purchaser. Make checks and money orders payable to Wilfrid Wheeler, Secretary, State Board of Agriculture.

Postage to any point in Massachusetts, Rhode Island, Connecticut and southern Vermont and New Hampshire is 9 cents.

Postage on the two Bird Books in one package is 14 cents to points within the first and second zones.

NATURE LEAFLETS.

Free, postpaid, on request. Available to teachers in quantities as desired, and as editions permit. Order by number.

1. "Canker Worms," by A. H. Kirkland. Fourth edition. Illustrated.
2. "Tent Caterpillars," by A. H. Kirkland. Third edition, revised. Illustrated.
3. "The Black-knot of the Plum and Cherry," by G. E. Stone. Third edition, revised. Illustrated.
5. "The White-marked Tussock Moth," by H. T. Fernald. Fifth edition. Illustrated.
6. "The Spiny Elm Caterpillar," by H. T. Fernald. Fourth edition. Illustrated.
7. "Potato Scab," by G. E. Stone. Fourth edition, revised. Illustrated.
8. "Insects Injuring Lawns: The May Beetle in Lawns and Ants in Lawns and Houses," by H. T. Fernald. Sixth edition. Illustrated.
9. "Poison Ivy," by G. E. Stone. Fifth edition. Illustrated.
10. "The Datanas," by H. T. Fernald. Third edition, revised. Illustrated.
11. "Quince Rust," by G. E. Stone. Fourth edition. Illustrated.
12. "Winter Birds at the Farm," by E. H. Forbush. Fourth edition, revised. Illustrated.
13. "Peach Leaf-curl," by G. E. Stone. Third edition, revised. Illustrated.
14. "Owl Friends," by E. H. Forbush. Fourth edition, revised. Illustrated.
16. "Our Friend the Chickadee," by E. H. Forbush. Fourth edition. Illustrated.

17. "Bordeaux Mixture," by G. E. Stone. Third edition, revised. Illustrated.
18. "Plant Lice or Aphids," by H. T. Fernald. Third edition, revised. Illustrated.
19. "Edible Weeds and Pot Herbs," by G. E. Stone. Third edition, revised. Illustrated.
20. "Massachusetts Weeds," by G. E. Stone. Third edition, revised. Illustrated.
21. "Potato Rots," by G. E. Stone. Third edition, revised. Illustrated.
22. Hints for Out-door Bird Study. I. "How to identify Birds." Seventh edition. Illustrated.
23. Hints for Out-door Bird Study. II. "How to find Birds." Seventh edition, revised. Illustrated.
24. Hints for Out-door Bird Study. III. "How to approach Birds." Seventh edition, revised. Illustrated.
25. Hints for Out-door Bird Study. IV. "How to attract Birds." Sixth edition, revised. Illustrated.
(Nos. 22, 23, 24 and 25, by E. H. Forbush.)
26. "The Brown-tail Moth," by A. H. Kirkland. Fifth edition. Illustrated.
27. "The Gypsy Moth," by A. H. Kirkland. Fifth edition, revised. Illustrated.
28. "The Garden Toad," by A. H. Kirkland. Fourth edition. Illustrated.
29. I. "School Gardens," by H. D. Hemenway. Fourth edition. Illustrated.
30. II. "Planting and Care of the School Garden," by H. D. Hemenway. Third edition. Illustrated.
31. III. "Crops for the School Garden," by H. D. Hemenway. Fourth edition. Illustrated.
32. IV. "Results of School Gardening," by H. D. Hemenway. Fourth edition. Illustrated.
35. "Window Gardening," by H. D. Hemenway. Third edition. Illustrated.
36. "Hotbeds," by H. D. Hemenway. Fourth edition. Illustrated.
37. "How to test Seeds," by H. D. Hemenway. Fourth edition.
38. "How to Plant," by H. D. Hemenway. Fourth edition. Illustrated.
41. "The European Elm-leaf Beetle," by A. H. Kirkland. Third edition, revised. Illustrated.
43. "The Leopard Moth," by W. S. Regan. Fourth edition. Illustrated.
44. "Root and Cleft Grafting," by H. D. Hemenway. Third edition. Illustrated.
45. "Planting and Care of Trees," by H. D. Hemenway. Second edition. Illustrated.
46. "How to Beautify the Home Grounds," by H. D. Hemenway. Second edition. Illustrated.
47. "Weed Eradication by Chemical Treatment," by G. E. Stone. First edition, 1915. Illustrated.
48. "Apple Scab," by G. E. Stone. Second edition. Illustrated.

MISCELLANEOUS.

Manual of Dairy Laws, compiled by P. M. Harwood.
List of Useful Books on Agriculture, June, 1917.
List of Farmers Institute Speakers, December, 1917.
Directory of Agricultural Organizations, April, 1918.
Plate I., showing the gypsy moth in its different stages.
Plate II., showing the brown-tail moth in its different stages.

Posters.

Colored, showing the different stages of the white pine blister rust.
Illustrating the grading of apples, under the Massachusetts Apple Grading Law.
Cloth, relating to poultry thieving.
Cloth, relating to trespassing.

Five copies of each of the cloth posters will be sent to any applicant free. Additional copies may be secured at the rate of 6 cents each.

LIBRARY.

The library of the State Board of Agriculture is open at the office of the Board, 136 State House, daily from 9 A.M. to 5 P.M., and Saturdays from 9 A.M. to 12 M. Here will be found for reference the leading farm papers, the publications of the United States Department of Agriculture, and of the several State agricultural colleges and experiment stations.

A circulating library of about 2,000 volumes on agriculture, horticulture, ornithology, rural economics and allied subjects offers any citizen of Massachusetts who can produce satisfactory references an opportunity to borrow books for periods of two to three weeks with renewal privilege.

Persons desiring further information with regard to the library should apply to R. Edwards Annin, Jr., Librarian, 136 State House, Boston.