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1913

THE

Fruit Growers Association

of Adams County

Pennsylvania

ORGANIZED DECEMBER 18, 1903

PROCEEDINGS

OF THE

NINTH ANNUAL CONVENTION

HELD IN

Fruit Growers Hall, Bendersville, Penna.

Wednesday, Thursday and Friday

December 17, 18, 19, 1913

OFFICERS

President, ... Robert M. Eldon, ... Aspers
1st Vice President, ... Robert Garretson, ... Flora Dale
2d Vice President, ... C. A. Griest, ... Guernsey
3d Vice President, ... C. E. Raffensperger, ... Arendtsville
4th Vice President, ... E. P. Garrettson, ... Biglerville
5th Vice President, ... W. E. Grove, ... York Springs
Recording Secretary, ... Chas. A. Wolfe, ... Aspers
Corresponding Secretary, ... Edwin C. Tyson, ... Flora Dale
Treasurer, ... Wm. S. Adams, ... Aspers

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Robert M. Eldon, ... Aspers
Robert Garretson, ... Flora Dale
C. A. Griest, ... Guernsey
C. E. Raffensperger, ... Arendtsville
E. P. Garrettson, ... Biglerville
W. E. Grove, ... York Springs
Chas. A. Wolfe, ... Aspers
Edwin C. Tyson, ... Flora Dale
Wm. S. Adams, ... Aspers

Membership Roll

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Adams, Mrs. W. S., ... Aspers, Pa.
Asper, D. C., ... Aspers, Pa.
Anstadt, Henry, ... Washington, D. C.
Anderson, H. W., ... Stewartstown, Pa.
Anderson, Joseph W., ... Stewartstown, Pa.
Anderson, H. M., ... New Park, Pa.

Bream, Samuel, ... Biglerville, Pa.
Bream, Dill, ... Bendersville, Pa.
Bream, C. D., ... Aspers, Pa.
Bream, M. F., ... York Springs, Pa.
Boyer, W. W., ... Arendtsville, Pa.
Black, Wm. H., ... Flora Dale, Pa.
Baugher, H. G., ... Aspers, Pa.
Baugher, Ira, ... Aspers, Pa.
Baugher, Martin, ... Aspers, Pa.
Bucher, John, ... Bendersville, Pa.
Belt, J. E., ... Wellsville, Pa.
Butt, J. L., ... Gettysburg, Pa.
Brough, Edward, ... Biglerville, Pa.
Bingham, W. O., ... St. Thomas, Pa.
Boyer, George E., ... Arendtsville, Pa.
Bushman, S. F., ... Gettysburg, Pa.
Brame, Edw., ... Aspers, Pa.
Blessing, David H., ... Harrisburg, Pa.
Black, Moses, ... Aspers, Pa.
Blair, C. I., ... Aspers, Pa.
Bream, W. A., ... Gettysburg, Pa.
Brinton, H. C., ... Hanover, Pa.
Brinser, E. C., ... Middletown, Pa.

Cocklin, B. F., ... Mechanicsburg, Pa.
Cook, Arthur E., ... Aspers, Pa.
Carey, J. Calvin, ... Gettysburg, Pa.
Carson, E. E., ... Bendersville, Pa.
Crouse, E. A., ... Gettysburg, Pa.
Cation, W. R., ... Orrtanna, Pa.

Deardorff, Anthony, ... Mummasburg, Pa.
Dock, Miss Margaret, ... Fayetteville, Pa.
Dock, Miss Myra L., ... Fayetteville, Pa.
Deardorff, W. B., ... Gettysburg, R. F. D. No. 5, Pa.
Dill, Dr. M. T., ... Biglerville, Pa.
Dull, Thomas, ... Aspers, Pa.

Dunlap, James M.,	Walnut Bottom, Pa.
Dougherty, Dorsey,	Gettysburg, Pa.
Deatrick, H. G.,	Hunterstown, Pa.
Diller, O.,	York Springs, Pa.
Eldon, Robert M.,	Aspers, Pa.
Eldon, Mrs. R. M.,	Aspers, Pa.
Everhart, G. W.,	York, Pa.
Eby, Amos,	Mt. Joy, Pa.
Eiholtz, S. Mc.,	Biglerville, Pa.
Eppleman, H. C.,	Aspers, Pa.
Estabrook, F. L.,	Athens, Pa.
Fraim, Merritt L.,	Aspers, Pa.
Fohl, George E.,	Biglerville, Pa.
Fiddler, W. B.,	Aspers, Pa.
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French, Albert,	Montclair, N. J.
Fohl, Jas. O.,	Aspers, Pa.
Griest, C. Arthur,	Guernsey, Pa.
Griest, Mrs. C. A.,	Guernsey, Pa.
Griest, C. S.,	Guernsey, Pa.
Griest, A. W.,	Flora Dale, Pa.
Griest, Frederic E.,	Flora Dale, Pa.
Griest, G. G.,	30 Church St., N. Y. City.
Griest, Maurice,	105 W. 163d St., N. Y. City.
Griest, C. J.,	York Springs, Pa.
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Garrettson, Eli P.,	Biglerville, Pa.
Garrettson, Harriet,	Biglerville, Pa.
Garrettson, J. B.,	Aspers, Pa.
Garrettson, Robert,	Flora Dale, Pa.
Garrettson, John,	Aspers, Pa.
Garrettson, Eli,	Gettysburg, R. F. D. No. 6, Pa.
Grove, W. E.,	York Springs, Pa.
Gillan, R. J.,	St. Thomas, Pa.
Groupe, Foster C.,	Idaville, Pa.
Gardner, L. M., Jr.,	York Springs, Pa.
Gove, Mary E.,	Bendersville, Pa.
Howard, Jno. M.,	Aspers, Pa.
Harris, Meriam,	Bendersville, Pa.
Hoffman, Jas. O.,	Arendtsville, Pa.
Hoffman, E. N.,	Biglerville, Pa.
Hoffman, Daniel,	Aspers, Pa.
Hoffman, George,	Arendtsville, Pa.
Hoffman, Willis H.,	Biglerville, Pa.
Harshman, U. W.,	Waynesboro, Pa.
Huber, Charles H.,	Gettysburg, Pa.

Hartman, Geo. R., ... Biglerville, Pa.
Hull, D. W., ... Waymart, Pa.
Hummel, P. T., ... Harrisburg, Pa.
Hershey, C. A., ... McKnightstown, Pa.
Horting, John, ... Arendtsville, Pa.
Huber, Henry S., ... Idaville, Pa.

Jacobs, Daniel C., ... Gettysburg, R. F. D. No. 5, Pa.

Keller, H. M., ... Gettysburg, R. F. D. No. 5, Pa.
Klinefelter, U. S., ... Biglerville, Pa.
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Kane, J. Lewis, ... Gettysburg, R. F. D. No. 6, Pa.
Knouse, J. A., ... Arendtsville, Pa.
Knouse, David, ... Arendtsville, Pa.
Koser, Rev. D. T., ... Arendtsville, Pa.
Koser, G. W., ... Biglerville, Pa.
Kunkle, John R., ... Gettysburg, Pa.
Knouse, Prof. Roy D., ... Arendtsville, Pa.

Longsdorf, C. L., ... Biglerville, Pa.
Lawver, Rufus W., ... Biglerville, Pa.
Lawver, J. Edw., ... Biglerville, Pa.
Longsdorf, Dr. H. H., ... Dickinson, Pa.
Lady, Hiram C., ... Arendtsville, Pa.
Lupp, Reuben, ... Biglerville, Pa.
Large, Mrs. E. S., ... Orrtanna, Pa.
Large, Miss Katharine, ... Orrtanna, Pa.
Lower, Dr. S. E., ... Pittsburgh, Pa.

Michener, Mrs. Chas., ... Bendersville, Pa.
Myers, George P., ... Biglerville, Pa.
Merz, Geo., ... Webster, N. Y.
McKay, Geo. H., ... Philadelphia, Pa.
Mayer, Dr. I. H., ... Willow Street, Pa.
Morrison, Mrs. W. S., ... Aspers, Pa.
Minick, D. N., ... Chambersburg, Pa.
Minter, Thomas L., ... Biglerville, Pa.
Musselman, C. H., ... Biglerville, Pa.
Musselman, J. Elmer, ... Gettysburg, Pa.
Minter, Mrs. D. G., ... Gettysburg, Pa.
Myers, Levi M., ... Siddonsburg, Pa.
Miller, Robt. C., ... Gettysburg, Pa.
Miller, E. M., ... Hanover, Pa.
Moyer, Dr. H. B., ... Cape May, N. J.
Mickley, J. W., ... Fairfield, Pa.
Musser, Will M., ... Lampeter, Pa.
Maloney, W. J., ... Dansville, N. Y.

Newcomer, Aaron,	Smithburg, Md.
Nissly, Christian L.,	Florin, Pa.
Nissly, Alvin R.,	Hanover, Pa.
Oyler, Geo.,	Gettysburg, Pa.
Oyler, George C.,	Gettysburg, Pa.
Orner, P. S.,	Arendtsville, Pa.
Prickett, Josiah W.,	Biglerville, Pa.
Peters, Z. J.,	Guernsey, Pa.
Peters, H. W.,	Aspers, Pa.
Peters, W. V.,	Guernsey, Pa.
Peters, Curtis W.,	Biglerville, Pa.
Peckman, Frank R.,	Gettysburg, Pa.
Pitzer, Harry C.,	Aspers, Pa.
Peters, Geo. M.,	Aspers, Pa.
Pratt, B. G.,	New York City.
Pitzer, Willis,	Arendtsville, Pa.
Raffensperger, Chas. E.,	Arendtsville, Pa.
Raffensperger, Roy,	Arendtsville, Pa.
Rice, E. E.,	Aspers, Pa.
Rice, Waybright,	Biglerville, Pa.
Rice, C. S.,	Arendtsville, Pa.
Rice, Oscar C.,	Arendtsville, Pa.
Routzahn, George R.,	Bendersville, Pa.
Rinehart, E. S.,	Mercersburg, Pa.
Rinehart, J. J.,	Smithburg, Md.
Roberts, Arthur,	Gettysburg, Pa.
Reist, Henry G.,	Schenectady, N. Y.
Repp, Albert T.,	Glassboro, N. J.
Riddlemoser, H. E.,	McKnightstown, Pa.
Rex, Raymond,	Idaville, Pa.
Stover, Dr. J. G.,	Bendersville, Pa.
Strong, Geo. C.,	Orrtanna, Pa.
Slaybaugh, Elmer,	Aspers, Pa.
Smith, G. Frank,	Aspers, Pa.
Stephens, Henry M.,	Carlisle, Pa.
Stouffer, F. W.,	Gettysburg, Pa.
Sheely, Emory,	Arendtsville, Pa.
Shull, Jno. A.,	McKnightstown, Pa.
Shull, Robt. H.,	McKnightstown, Pa.
Stewart, William,	Landisburg, Pa.
Spangler, George E.,	Gettysburg, Pa.
Snyder, E. B.,	Jack's Mountain, Pa.
Snyder, Jacob S.,	Idaville, R. F. D., Pa.
Snyder, W. L.,	Bendersville, Pa.
Sachs, Edw. S.,	Biglerville, Pa.

Stock, E. C.,	3510 Clifton Av., Balto., Md.
Strasbaugh, E. F.,	Orrtanna, Pa.
Sheffer, E. Kate,	Boiling Springs, Pa.
Sheely, A. D.,	Arendtsville, Pa.
Stover, Mrs. Dr. J. G.,	Bendersville, Pa.
Tyson, Edwin C.,	Flora Dale, Pa
Tyson, Mrs. M. W.,	Flora Dale, Pa
Tyson, Chester J.,	Flora Dale, Pa.
Tyson, Mrs. B. H.,	Aspers, Pa.
Tyson, Wm. C.,	Guernsey, Pa.
Tyson, Mrs. M. E.,	Guernsey, Pa.
Taylor, Jacob F.,	Arendtsville, Pa.
Tyson, A. R.,	Norristown, Pa.
Taylor, Dan'l R.,	Biglerville, Pa.
Taylor, Henry,	Biglerville, Pa.
Trostle, Francis,	York Springs, R. F. D., Pa.
Thomas, Mrs. Annie M.,	Gettysburg, Pa.
Taughinbaugh, W. A.,	Gettysburg, Pa.
Taylor, Ralph S.,	West Chester, Pa.
Ullrich, L. L.,	Biglerville, Pa.
Weidner, A. I.,	Arendtsville, Pa.
Wolfe, C. A.,	Aspers, Pa.
Wolfe, Harry E.,	Aspers, Pa.
Wolff, Dr. W. E.,	Arendtsville, Pa.
Wolf, Charles M.,	York Springs, Pa.
Weaver, Mrs. C. M.,	New Oxford, Pa.
Weaver, David I.,	Biglerville, Pa.
Wilson, B. F.,	Biglerville, Pa.
Weaner, Chas. C.,	Bendersville, Pa.
Weaner, W. C.,	Aspers, Pa.
Wertz, D. M.,	Quincy, Pa.
Wible, R. E.,	Gettysburg, Pa.
Wickersham, Ruth A.,	Bendersville, Pa.
Wickersham, Robt. A.,	Bendersville, Pa.
Wright, Ryland,	Aspers, Pa.
Wright, T. F.,	Aspers, Pa.
Williams, J. L.,	Gettysburg, Pa.
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CONSTITUTION

PREAMBLE.

Being interested in fruit growing and believing that, by organization, we may materially advance our common interests, we hereby adopt the following Constitution and By- Laws.

ARTICLE I.—*Name.*

This Association shall be known as The Fruit Growers' Association of Adams County.

ARTICLE II.—*Object.*

The object of this Association shall be to encourage the co-operation of the fruit growers of Adams County for the protection and advancement of their common interests.

1st. By securing and disseminating such scientific and practical information as shall promote the general advancement of the fruit growing interests in this county, and shall tend to the improvement of the quality and quantity of our products.

2d. By securing such legislation as may be advantageous, and preventing that which may be detrimental.

3d. By securing such improved facilities in transportation as shall tend to give us more expeditious and economical distribution.

4th. By endeavoring to secure a better and more uniform system of packing and package.

5th. By devising some system of marketing our products which will open up and develop the markets and give to the grower a fair and remunerative return.

6th. And by endeavoring to obtain such improved systems of crop reporting as shall furnish, through co-operation with other similar Associations, accurate information concerning production; thereby enabling the fruit grower to know the exact situation.

ARTICLE III.—*Membership.*

1st. Candidates for membership may be elected by a majority vote of the members present, and upon the payment of $1.00 into the treasury shall be entitled to membership until the next Annual Meeting.

2d. Any member may renew his membership by the payment of annual dues, but upon failure to pay dues within three months after Annual Meeting, shall require re-election.

3d. No member shall receive the benefit of commissions or of co-operative buying by the Association, to an amount greater than $1.00 for the term of one year after election to membership.

ARTICLE IV.—*Dues.*

The annual dues of this Association shall be One Dollar, ($1.00) payable to the treasurer at the meeting immediately preceding the annual meeting, for which the Treasurer shall issue a receipt, this receipt to constitute a certificate of membership for the succeeding year.

ARTICLE V.—*Officers.*

Its officers shall consist of a President, a First, Second, Third, Fourth and Fifth Vice President, a Recording Secretary, a Corresponding Secretary, and a Treasurer, all of whom shall be elected by ballot at each Annual Meeting, to serve for the term of one year or until their successors shall be chosen. These nine (9) elective officers shall constitute an Executive Committee.

ARTICLE VI.—*Quorum.*

Five (5) members shall constitute a quorum for the transaction of business.

ARTICLE VII.—*Amendments.*

The Constitution and By-Laws of this Association may be amended at any regular meeting by a two-thirds vote of the members present, a notice of the proposed amendment having been presented in writing at a previous regular meeting.

ARTICLE VIII.—*Fruit Districts.*

For the purpose of distributing the work of the Association and extending its scope, the County of Adams shall be divided into the following seven (7) districts: District One, or North District, to consist of Menallen Township; District Two, or West District, to consist of Franklin Township; District Three, or Southwestern District, to consist of Highland, Liberty and Hamiltonban Townships; District Four, or South District, to consist of Cumberland, Freedom and Mt. Joy Townships, and that portion of Straban Township lying south of the Western Maryland Railroad; District Five, or Eastern District, to consist of Germany, Union, Conowaga, Mt. Pleasant, Oxford, Reading, Berwick and Hamilton Townships; District Six, or Northeastern District, to consist of Latimore, Huntingdon and Tyrone Townships; District Seven, or Central District, to consist of Butler Township and that portion of Straban Township lying north of the Western Maryland Railroad.

ARTICLE IX.—*Committees.*

The following five (5) committees shall be appointed annually by the newly-elected Executive Committee and announced at the January meeting, as follows: A committee on programs, a committee on membership, a committee on statistics, a committee on exhibits and a committee on crop reports; each committee shall be composed of one or two members from each of the seven (7) districts of Adams County, as designated in Art. 8, and one or two from each of the Counties of York, Cumberland and Franklin.

BY LAWS

ARTICLE I.—*Duties of President.*

The President shall preside at all meetings of the Association and have a general supervision of its affairs.

ARTICLE II.—*Duties of Vice Presidents.*

The highest designated Vice President present at any meeting shall preside in the absence of the President; all of the five vice presidents shall serve on the Executive Committee in conjunction with the other elective officers; and, in addition, each vice president shall have special duties as follows:

The First Vice President shall be chairman of the program committee, and be responsible for the preparation of a program for each regular meeting, same to be announced at the preceding meeting.

The Second Vice President shall be chairman of the membership committee, and shall use every effort, personally and through members of his committee, to extend the membership and secure renewals.

The Third Vice President shall be chairman of the committee on statistics, and shall be responsible for the preparation of statistics showing number of orchards in Adams County, and, as far as possible, in York, Cumberland and Franklin Counties, with quantity, age, kind and variety of trees planted therein, for the use of the Association, adding thereto as new orchards are planted or old ones extended.

The Fourth Vice President shall be chairman of the committee on exhibits, and have entire charge of securing fruit for exhibits and displaying same as directed by the Association.

The Fifth Vice President shall be chairman of the committee on crop reports, and have entire charge of collecting and compiling same for use of the Association.

ARTICLE III.—*Duties of Recording Secretary.*

The Recording Secretary shall write the minutes of the meetings of the Association and have charge of its Records and Reports.

ARTICLE IV.—*Duties of Corresponding Secretary.*

The Corresponding Secretary shall conduct the correspondence of the Association and shall receive for so doing his necessary expenses for stationery, postage, etc. He shall also act as Recording Secretary in the absence of that officer.

ARTICLE V.—*Duties of Treasurer.*

The Treasurer shall receive and keep an accurate account of all moneys belonging to the Association, paying out same on an order of the Association, signed by the President. He shall make a report of all receipts and disbursements at the annual meeting or at any time at the request of the Association. He shall mail a notice of dues to all members one week prior to the November meeting, at which time all dues are payable, and shall issue certificates of membership in exchange for all dues received. He shall also keep a roll of members who have complied with Article IV of the Constitution and embody same in his annual report.

ARTICLE VI.—*Duties of the Executive Committee.*

The Executive Committee shall have general supervision of the affairs of the Association, auditing all bills and accounts and carrying out the purposes of the Association.

ARTICLE VII.—*Meetings.*

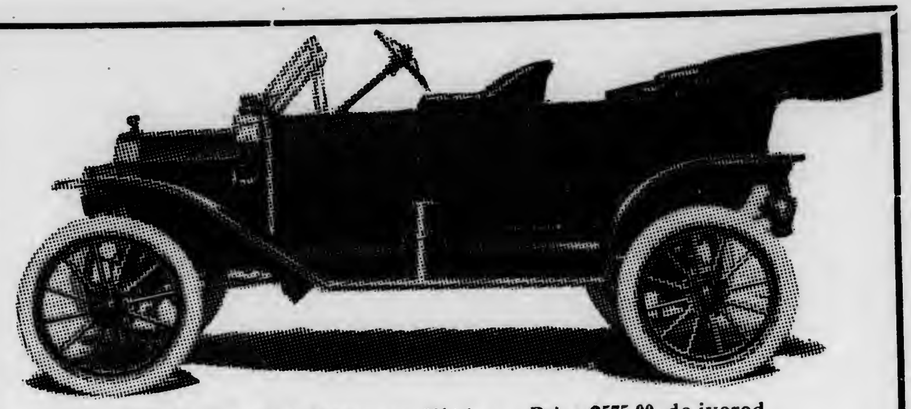
There shall be a regular meeting of the Association on the second Saturday of each month at 7:30 P. M., unless otherwise ordered. The meeting held in December to be regarded as the Annual Meeting. Special meetings may be convened by the Executive Committee at such time as they may appoint.

ARTICLE VIII.—*Initiation of Officers.*

All new officers shall assume the duties of office at the opening of the meeting immediately following the one at which they were elected, except that the newly-elected Executive Committee shall prepare and announce, at the January meeting, the membership roll of the five (5) committees specified in Art. 9, and the chairman of program committee shall prepare a program for the February meeting and announce same at the January meeting.

ARTICLE IX.—*Order of Business.*

1st. Reading of minutes of previous meeting.
2d. Nominations and elections.
3d. Reports of committees.
4th. Deferred business.
5th. Communications.
6th. New business.
7th. Discussion of questions.



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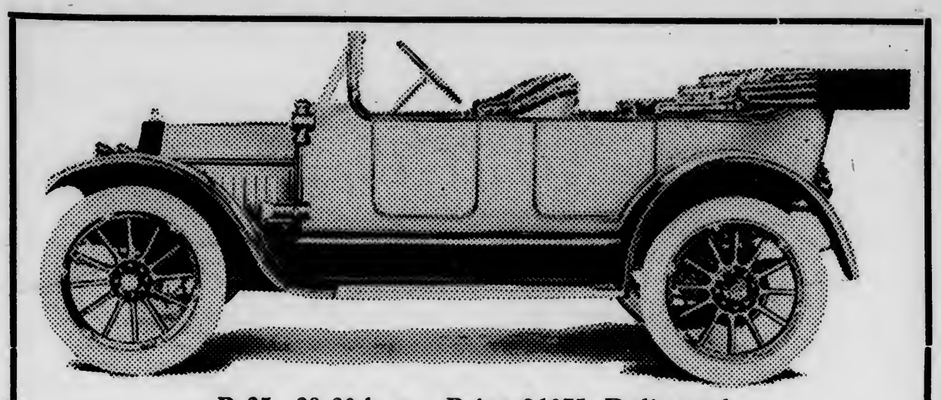

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PROCEEDINGS

OF THE

NINTH ANNUAL CONVENTION

OF THE

FRUIT GROWERS ASSOCIATION

OF

ADAMS COUNTY, PA.

The Ninth Annual Convention was called to order by the President, Robert M. Eldon, at 2:00 p. m., Wednesday, December 17, 1913, in Fruit Growers' Hall, Bendersville, Pa.

The convention was opened with prayer by the Rev. D. T. Koser.

Following a few well chosen words of welcome by the President, the program was proceeded with as follows:

SOME IMPORTANT INSECT PESTS AND THEIR CONTROL.

By Dr. John P. Stewart, *Experimental Pomologist, State College, Pa.*

The insects that we shall consider chiefly in this discussion are the aphids and red bugs of the apple. All the fruit-growing regions of America are affected by the apple aphids, while the red bug injuries are thus far largely confined to the Middle Atlantic States and Ontario. The apparent absence of the latter insects from other regions, however may be due to insufficient observation or reports.

These pests are not especially closely related though both are sucking insects. Fortunately they appear at about the same time and can be controlled with the same materials which may usually be applied with the regular sprays already used in the best orchard practice without increasing the number of applications.

The Apple Aphids.

Five species of aphids infest the apple. Their relative importance varies somewhat with the locality and also with the age of the trees. In the Eastern half of the country the species that are

usually worst are the woolly aphis, *Schizoneura lanigera;* the common apple aphis, *aphis pomi;* and the European grain aphis, *Siphocoryne avenae.* The rosy aphis, *Aphis sorbi,* is also becoming important in some localities, and it appears to be the most serious form in the apple growing sections of the Far West. Besides these the clover aphis, *Aphis bakeri,* uses the apple, pear, quince and hawthorn as winter hosts, and occurs actively on them in late fall and early spring. It has been noted especially in Colorado and the Far West.

The wooly apple aphis is readily distinguished from the others by the fact that it becomes practically covered with a bluish-white waxy substance secreted from its abdomen. It also infests the roots as well as the tops, which is not true of any of the other species found on apples. It has been discovered very recently that the apple, pear and hawthorn are really only the secondary or summer hosts of this aphid—notwithstanding the fact that its "agamic" forms usually remain on them throughout the year—and that the elm is the real or primary host for the sexual generation and also for the first two spring broods and part of the third, all of which have been quietly operating for years under another name.

This is just the reverse of the host relation which the apple bears to the four other species. It also makes evident the hitherto unsuspected practical fact that both nurseries and orchards should be kept at a safe distance from all susceptible species of elms, and under no circumstances should such elms and apples be raised in the same nursery.

The insect itself varies from a light green to a dark rusty-brown color, and it attains a maximum length of about two millimeters, or a twelfth of an inch. As multiplication proceeds the colonies gradually develop into small cottony masses, which are fairly conspicuous above ground, where they occur especially on succulent twigs or round abrasions or scars left by the pruning. In these situations their feeding usually results in objectionable swellings or calluses, which often distort the twigs and delays healing.

Their presence above ground almost always indicates that others are feeding on the roots, where they develop conspicuous gall-like swellings or knots. These knots usually result in the death of the affected roots in a comparatively short time unless the injury is checked. This injury is especially severe on young trees, and the insect is usually distributed on nursery stock, by means of which it has already been carried to practically every important apple-growing region in the world. For this reason all such stock should be carefully inspected for the typical enlargements, especially on the roots and the diseased trees should either by rejected or else all signs of infestation should be removed and the remaining roots dipped or thoroughly sprayed.

This is probably best accomplished with a kerosene emulsion diluted to contain about fifteen per cent. of kerosene, or with a tobacco extract diluted at the rate of one part of the extract to five

or six hundred parts of water. One or two minutes is sufficient for the dipping, after which the trees should be spread out and dried for a few minutes before planting or heeling in.

When this aphis becomes serious on the roots of trees already planted the only method of control that has proved really effective is partially to expose the principal infested roots by drawing the soil away for a distance of two to four feet from the trunk, and to saturate this area with kerosene emulsion at a strength of about ten per cent. of kerosene. From two to seven gallons of emulsion will be required to saturate properly such an area, and the soil should be replaced immediately after the application. As indicated by work in Georgia, where this pest is often very severe, the safest and best time for these applications is apparently during the season of active growth, and not later than the middle of July. In this work the kerosene emulsion not only killed all the aphids wherever it came in contact with infested roots, but its fumes remained in the soil for several months and served as an effective repellant against any return of the pest to the principal roots. Other materials which were found relatively unsatisfactory in this work were tobacco dust and stems, carbon bisulphide, solutions of whale-oil soap, kainit and common salt. Mr. Smith estimates the damage caused by this aphis to be about fifteen per cent., or $150,000, annually for the state of Georgia alone.

This same treatment is likely to be effective against the root-infesting form of the black peach aphis, Aphis persicaeniger. This is a native species with habits similar to those of the woolly apple aphis, but occurring on the peach, especially in the Middle Atlantic states. The aerial forms of both insects can be controlled by the methods indicated for the aphids described later.

The Other Apple Aphids.—Unlike the woolly aphis the other apple aphids confine their attacks almost wholly to the foliage and tender shoots, though some of them also attack the young fruit directly. These attacks result in curled leaves, stunted twigs, and clusters of dwarfed, misshapen and worthless fruit. They also emit considerable quantities of honeydew, which spreads over the foliage and fruit, attracting ants and furnishing the culture medium for a black and sooty fungous growth. This growth is harmless, but is rather disfiguring, and it is due to certain genera—Apiosorium, Capnodium, etc., of the burnt-wood fungi, the Pyronomyostes.

Only one of these aphids remains on the trees throughout the season. This is the common or green apple aphis, and it is apparently confined entirely to the apple, pear and hawthorn. The other three species use the apple merely as their winter and spring host, developing only their first two or three broods on it. Then they practically vanish, usually by the first of July or earlier. This disappearance is simply a migration to other plants, on which the summer generations are developed. In the case of the grain aphis the summer host plants are the small grains and grasses, while those of the clover aphis are the clover and alfalfa. The summer host of

the rosy aphis is not yet known. In the fall, about with the earliest frosts, winged forms of all these species again appear on the apple and give rise to the true males and females, which in turn produce the wintering eggs.

All five species pass the winter in the egg stage, though the woolly aphis also regularly hibernates in the active stage on the roots. The eggs are small, black, shining, oval bodies,—those of the common aphis measuring about .24 by .6 of a millimeter. They are laid chiefly on the terminal twigs, except those of the woolly aphis, which are occasionally found in crevices on the trunk near the ground. Recent observations by Miss Patch in Maine and by others in Oregon have shown that the elm is the regular winter host for the eggs and attendant generations of the latter insect, and the occurrence of its eggs on the apple is therefore probably accidental and of no value to the species. The eggs of the other species are readily found throughout the winter on apples or related trees, especially round the buds or in the crotches and small crevices on the twigs.

Characteristics of the Different Species.—It is rather hard to distinguish the eggs of the different species. Those of the rosy aphis are only about half as large as those of the common aphis and are somewhat more pointed at the ends.

In the active stage **the rosy aphis** is probably best distinguished by the presence of two pairs of minute tubercles on the segments just above the tail. The mature wingless female is about a tenth of an inch long. In color and general appearance this species varies decidedly in the different seasons. In early spring the first broods are greenish blue, covered with a white powder. About the first of June pink or salmon-colored forms appear. With fuller maturity these latter forms develop wing pads, whereupon they are called pupae. Still later they change to brownish or black-winged migrants. In late October the small, whitish, egg-laying females appear, and remain on the trees until killed by the more severe frosts, usually in the latter part of November.

This species confines its attacks almost wholly to the leaves and it seems to prefer those on the fruiting spurs. The injury to these leaves is so severe that the adjacent fruit usually remains small and becomes gnarled and deformed into the so-called gall apples, which may stick to the tree long after the leaves have fallen.

The common apple aphis when full grown is about two millimeters, or a twelfth of an inch, long in all generations except the first and last, in which the adults do not exceed a sixteenth of an inch in length. The mature forms of all broods, except the males and egg-laying females which appear in late fall, are light green, with black antennae, head and thorax, and black honey-tubes or cornicles. The males are pinkish brown and wingless, while the mature egg-laying females are lemon-yellow and also wingless.

The European grain aphis resembles the common apple aphis in general appearance and color but the wingless females are distinctly smaller and have transverse, spindle-shaped bands of darker green across the abdomen. Their cornicles are also shorter, lighter colored, enlarged at the middles and flared at the tips. The winged forms are darker and lack the transverse bands, but they may be distinguished by the short outer fork in the median vein at the tip of the fore wing.

The adults of the first brood of **the clover aphis** vary from a dark green, streaked and mottled with red to a deep dark red. The cornicles are very short and pale yellow. The second generation is light green or yellowish green, while the summer generations on clover are pink or yellowish, with a large, pale, orange-colored spot round the base of each cornicle.

Methods of Control.—The eggs of most species begin hatching about as the buds start swelling, or slightly earlier. The aphids immediately move to the tips of the buds and begin crowding and working their way down among the green unfolding leaves—a habit which enables them to reach protected situations quickly. Now is the psychological moment for their control. The young lice—or stem-mothers, as this generation is called—are weakest and least protected just at this stage, and they can now be destroyed most readily by thorough applications of the proper sprays.

The most effective material is probably a tobacco extract, although a seven per cent. kerosene emulsion is also satisfactory, especially if it is not combined with other material. Tobacco extracts may apparently be combined with any of the lime-sulphur sprays without reduction in the effectiveness of either constituent. For the aphis a solution containing about .05 of one per cent. of nicotine sulphate is required. Hence such a preparation as "Black-Leaf 40," which contains at least forty per cent. of this sulphate can be diluted at the rate of one to 800, or about a pint to 100 gallons of spray mixture.

If these materials are to be used alone it is best to add a little dissolved soap, at the rate of one or two pounds to fifty gallons of spray material, to increase their spreading and wetting qualities. If they are added to lime-sulphur, however, the soap is not needed, and it may even be objectionable if arsenate of lead is also to be used.

Where the San Jose scale is present and the amount of spraying is not too great per machine, it will probably be best to defer the scale spray, and then use the combined sulphur and nicotine spray in a single application for both scale and aphids, and also for apple scab and the red bugs. As a rule the scale strength of lime-sulphur —1.03 specific gravity—can be used on apples without material injury, at least until the pink begins showing in the tips of the blossoms. This should allow several days for most effective and economic spraying. If the scale is absent or otherwise provided for, the present period can be devoted to scab, aphids and red bugs, and the lime sulphur strength reduced to about 1.01.

The necessity for extremely thorough work against the aphids

may be understood when it is realized that all the individuals in the spring and summer are agamic females. These forms reproduce without fertlization, the young being born alive and numbering from fifty to one hundred from each individual. The latter reach maturity in about two or three weeks in the earlier broods, and in a week or ten days during the summer. The earlier broods are usually wingless, although winged forms may often appear in the second or third generation, and they become more common as the season advances or as the necessity for migration arises. A single escaping insect in the spring may therefore be represented by many colonies and many millions of descendents before fall.

The Apple Red Bugs.

The apple red bugs are about a quarter of an inch long in the adult stage, and range from 1.2 to 4.3 millimeters long in the various nymphal stages. There are two species affecting the apple. one of which is called the red bug and the other the false red bug although the latter is the redder.

The nymphs of both species are a brillinat tomato-red at first, with a few dusky markings. The latter becomes more prominent with increasing maturity, especially about the thorax and head in the case of the red bug. This insect in its adult stage may become nearly black over the fore part of its body, while its dorsal surface is covered with white scalelike hairs. The false red bug lacks these hairs and its beak is light colored or translucent, with a dusky tip.

The eggs of both species are laid in twigs, preferably in two-year-old wood, late in June or early in July. Those of the red bug are inserted in slits made in the bases of fruit spurs; those of the other bug are inserted in pairs in the lenticels. The former begin hatching soon after the fruit buds open and are through when the blossoms open. The latter hatch about a week later.

The young nymphs are rather shy, but are very active. The first indication of their presence is likely to be the clusters of minute reddish dots on the young leaves, caused by the punctures of their needle-like beaks. Their presence may be determined earlier by placing branches of bearing wood in water any time after March 1st, to forc out the buds. If present the brilliant-red nymphs should appear soon after the leaves.

As soon as the fruit is set they begin feeding on it. The fruit punctured most severely usually drops; that remaining on the tree may mature, but it becomes dwarfed, knotty and practically worthless. I have found a reduction of more than sixty-one per cent. in the size of infested apples.

The habits of the bugs, together with experiments and commercial practice in New York, indicate that the best times to spray for these insects are: 1. Between the opening of the buds and petals for the red bug. 2. Immediately after petals fall for the false red bug and for stragglers from the earlier species. Nicotine solutions

at the strengths indicated above for the aerial forms of the aphids should be used. In the second spray these solutions should be added to the more diluted forms of lime-sulphur, and if scale is not involved this form is probably best for both sprays. The usual lead arsenate for the apple worm can be added in the second spray without reduction in efficiency.

Scale Parasites.

In this connection I have been requested to say a word on the present status of the scale parasites. This is a little out of my line, but so far as I have been able to learn there have been four species of internal parasites of the San Jose scale found in Pennsylvania during the past season. These species, as identified by Dr. L. O. Howard, of the Bureau of Entomology, Washington, D. C., and reported in the *Tribune-Farmer*, of Nov. 23, 1913, are as follows:

Aphelinus fuscipennis (Howard).
Prospaltella perniciosi (Tower).
Signiphora negrita (Ashmead).
Anagrus spiritus (Girault).

Of these, the first two are well-known enemies of the San Jose scale, and the last two, although known and named for some time, their exact relation to the scale is not so well understood.

The first one, *Aphelinus fuscipennis*, was reported as especially abundant in Maryland by Professor W. G. Johnson, in 1898, and an account of his observations upon it is given in bulletin No. 57, of the Maryland Station, and also briefly reported in bulletin No. 62 of the Federal Bureau of Entomology, which was published in 1906. This bulletin also gives a brief account of a number of species of internal parasites of the scale.

None of these species therefore is really new, so far as determined at present, and in one instance, viz., that of *Anagrus spiritus*, it is held by some Entomologists, notably by Dr. Henry Skinner, of the Academy of Natural Sciences, Philadelphia, that this species is not a parasite of the scale at all, but instead is an egg parasite probably infesting the eggs of the true parasite and thus is a friend rather than an enemy of the scale. This indicates the possible danger of a wide transfer of infested twigs until the exact nature of the parasites on them has been definitely determined.

Also, notwithstanding the fact that very great benefits have undoubtedly been obtained from the work of these parasites during the past season, it is inadvisable to place too much reliance on these insects until their activities have been observed over several seasons. Judging from their records in the past they are likely to be abundant in one year and practically absent the next. Consequently, the usual methods of control by means of spraying should not be discarded until we have much more definite observations of the present parasites extending over a number of seasons.

PROBLEMS OF AGRICULTURAL DRAINAGE.

HENRY T. COX, *Geneseo, N. Y.*

I am glad to be with you and to present a paper on the subject of drainage, with emphasis on its benefits to the fruit grower.

Intelligent agricultural pursuits bring men in closer touch with nature and nature's forces, than does any other occupation extant, and he of a thoughtful mind and keen habits of observation must necessarily develop the student.

We live in the midst of continual change. Look which way we will, the evidence is before us. There is no better illustration of this than we have in the tree, the bare branch, the buds, the leaf, the blossom, and the matured fruit.

We often think that we start something, when a little study will convince us that we have only stepped on the moving platform of change, and have done our little part, sometimes with satisfactory results, but often by neglecting the rule of the forge to "weld the iron when the heat is right," we fail to reach the success that is possible.

By natural forces the earth's surface conformation is continually undergoing changes, as is the soil conditions. The earth in its primitive state, that which was not under water, was covered with either tree or other lesser vegetable growth, in either case the soil and subsoil was penetrated by innumerable root growths, and the earth was enriched with the annual supply of humus, afforded by the decay of vegetation. After it becomes necessary to bring the soil under cultivation, the process destroyed all this root growth in the soil, leaving it filled with innumerable small passages. These admitted of drainage in a measure, and also aeration. After generations of tillage, in a great majority of our soils, the store of humus has been too heavily drawn upon, the soil has become more compact, the natural drainage referred to has become inoperative, both by natural process, as well as by shallow plowing and tilling the soil when it is too wet, a process that is apt to create the "plow soil" that we read about. In all this, capillary attraction has been sadly interfered with, and soil conditions are far from normal.

I was converted to the economy and profit of tile drainage of land when yet a mere lad. The transformation of acres returning meagre crops, often showing more loss than gain, into acres that produced magnificent crops and big profits, was, to me, an object lesson I have never forgotten. Early impressions thus compelled me to become a disciple of drainage, and later a missionary in the cause.

The practice is much more prevalent than formerly. An old Scotch weather prophet once met Lord Balfour and said: "My lord, we are going to have a long rain; it's going to rain seventy-two

days." "Come, come," said the statesman, "the world was entirely flooded when it rained forty days. "Aye, aye," was the response, "but the world was'nae drained as it is now."

But with all that has been done in the way of farm drainage, a beginning has just been made. Thousands of acres of what could be made our best and most profitable land lays entirely waste, and more thousands of acres are being cultivated at a loss because the whole or parts of fields are too wet to be prepared properly for a crop in season for planting or sowing, the sodden and lumpy condition of the seed bed rendering impossible a profitable crop.

Yet that land is not poor though it produces very indifferent crops; on the contrary, it is rich in elements of plant food. These elements, however, are under lock and key. The lock is the excess of water in the soil and subsoil; the key is the tile drain. And man is the appointed agent to manipulate the key. It is strange that he does not more often avail himself of this method and enter into the storehouse of plenty, over which nature stands guard with beckoning hand to him who has the password. The longer our fields and farms have been under cultivation, the more need of drainage. There is more profit from a small acreage made thoroughly productive than can result from a much larger proposition from which poor returns are the rule.

The prospect for agriculture and fruit production in this country was never more promising than at the present time. Immigration is attracted towards us from the four corners of the earth. The demand for the necessities of life is on the increase, for a large percentage of this vast multitude that is steadily pouring in upon us is of the consuming class, the factories of the city, the mining industry, etc., absorbing the greater share. Still, it will be generations before all our lands that can be utilized for agricultural purposes are developed and produce what they are capable of, we are still far from resorting to the methods employed in Holland and other countries of building dykes and reclaiming land lying entirely under water, we have not yet *begun* to touch even the agricultural possibilities of our great country.

In our own countys of Livingston and Monroe, which lay in that section of western New York that holds an enviable record in agriculture and fruit raising, there are hundreds of acres of what could be made our most productive lands that are not under cultivation at all, and more hundreds of acres that are under tillage that could be made doubly productive by proper drainage. This could be done with no great outlay of capital, for, after the first start, the increase in crop returns pays back in two years at most, and often with the first crop, the whole amount invested in the drainage work, and the permanent improvement still exists with its accompanying advantage each year of larger crops raised at less expense, because the yeast in the loaf is beginning to work.

I can cite you instance after instance that have come under my personal observation, and in many of which I have given personal

supervision, where for generations the fields and buildings had theretofore borne an annually increasing appearance of decadence and abandonment, but where proper drainage and lowering of the water level have produced results as wonderful as our childhood fairy stories—and the magic wand has been the drain tile, backed by a progressive spirit.

In fruit raising it is absolutely impossible to obtain satisfactory results if the land is overcharged with water, even for a part of the season. The meagre returns received from such land would indicate that the soil was poor, while in the majority of instances it is far from it. Still the little fibrous feeding roots seek in vain for substantial sustenance that lays around them but is absolutely unavailable. After drainage, *percolation* takes the place of *evaporation*. *Aeration* follows. A complete physical and chemical change has taken place in the soil. This, followed by intelligent fertilization and cultivation, is productive of such results that we get a better grip on our *profession* and feel a little of the rhythm of the progressive spirit that is throbbing around us.

Now, as this is a fruit growers' convention, I am going to cite two instances, one of the lack of drainage, the other where drainage has been employed, in apple orchards that have come under my personal observation.

One eighteen-acre tract was always referred to as the "Welch place back in the lane near the old brick yard." The man who owned the land on either side of it said that if it had been good for anything he would have bought it long ago, and got it cheap. That was its well-earned reputation. The back part was a low basin, and this kept the whole lot cold and wet. This tract was bought by our Mr. Doty, the proprietor of Marlborough farm, and thoroughly drained, the main line of tile through the rim of the basin being over six feet deep for quite a distance. The crops that this land has produced since its drainage would be a story by itself, but it is the orchard that I am going to tell about. This was at the front and on land somewhat higher than the level of the field. The varieties were Baldwins, Greenings, and Russets. The trees had a sickly, desolate and abandoned appearance. What little fruit that had grown on it was, for quantity and quality, hardly worth picking up for cider apples. The orchard was thoroughly drained, manure was applied and it was brought under cultivation, with the result that after one year's treatment it has produced annually a full crop of the finest apples grown in our Genesee Valley—and that's "going some." The orchard, I may add, has received proper spraying.

The other instance I have in mind is the twenty-acre orchard, known as the "Murphy Orchard." It was practically all Baldwins, planted on a sandy, loamy soil with a clay and hardpan sub-soil which was wet, although there was a gradual slope to the north and east. After coming into bearing it produced two or three fair crops of apples, but as the trees became older and the demands on the

soil for sustenance increased the trees began to take on an appearance of a seedy tramp orchard, and the production of marketable fruit ceased. At this stage, a man who thought he knew how to handle such an orchard, but who had been running a hardware store, and reading orchard literature, rented the orchard for a term of years, and began to fertilize, spray and plow the orchard. He had large ideas. The writer told the owner, at the time, that the land that the orchard occupied was worth more for general agriculture that it would ever be worth for profitable apple production. The result was, that the lessee lost his money, for the orchard had stood so long with wet, cold feet that every tree was diseased at heart, the branches and parts of the trees dying out every year—and now they are planning to pull it out. If this orchard had been drained before it had become so reduced in vitality, it could have been brought back by the methods that were applied when it was too late.

My own orchard in Monroe County, which is on soil varying from heavy Dunkirk clay to heavy loam, and all with a hardpan subsoil, was drained by the former owner before planting the trees, over thirty years ago, it was wet land although sloping. Since my ownership, it has been regularliy sprayed and pruned, but not as thoroughly cultivated as it should have been. Yet it has a great record, one year one thousand barrels of fruit and nearly two cars of drops. This year the crop, which was a light one as it was an off year, brought $1000. This six acres is the most profitable part of the farm and thorough drainage must have the credit. For it matters not that we buy the best trees plant with care manure and spray and prune if drainage is not present either natural or artificial failure is stamped on the venture from the beginning.

My paper thus far has treated the subject in a general way, touching on needs, practice and results. We will now take up the subject in a more detailed way. The appearance of trees and crop growth will indicate where drainage is necessary. I have seen many fields where the wet parts have drained and after this had been done these parts were dry and fit to work so much sooner than the parts that had been considered dry enough, that eventually the whole area was drained. It is a well-known fact that well drained land gets rid of the excess of water quicker and retains the necessary moisture longer than is the case where the land is not drained but where the water must soak away or evaporate. A study of the lay of the land should be made as to best outlet, grade and depth, surface and subsoil conformation. I have studied some fields two years or more before beginning operation, where conditions were difficult. The watershed to be taken care of as well as the general grade of this watershed must be considered. This to determine the size of tiles to be used, as well as the distance apart of the drains and their depth. In clay and hardpan subsoils 24 to 26 inches is deep enough for best results, while in easily drained soils, the depth can be greater. The distance apart of drains is to be

governed by conditions. This will vary from 30 to 100 feet. The location of the main and the angle of the laterals connecting onto it are governed by the slope of the land to be drained. This angle of the laterals will be around 40 degrees, sometimes more, sometimes less. My experience has been that best results are not obtained by running directly up a steep slope, but ascending by an angle greater or less according to the slope. The reasons are, that surface or soil water coming down the slope will be captured more readily where the drains are on an angle with the slope, where, if they were directly up the slope, the water would come down between the tiles quite a distance before seeping off into them. It has been figured out that it takes more tile to drain a field on an angle. This may be the case, but we are after results, and a few more tiles do not count much.

How are we going to dig the trenches? By using a team and plow the ditch can be opened up by shoveling out the loose dirt to a depth of sixteen or eighteen inches. Then, by spreading the horses and using a ditching plow and shoveling out the loose dirt most of the required depth can be obtained with very little use of pick and spade. We consider the Cyclone, Jr., the best ditching tool for loosening the earth in the trenches. This is made like a loop or a broad heavy band of steel, bent rounding on the bottom and coming up and bolting on the sides of the beam. This leaves the bottom of the ditch rounding, the best shape for tile laying as the tiles cannot roll or be pushed out of place so easily in filling. We have had many hundreds of rods dug by hand entirely, paying thirty-five cents a rod for digging the ditches thirty inches in depth, laying in the tile and filling in about ten or twelve inches of earth, the final filling in being done with plow and team. Six rods is the usual day's work for an experienced man, and he must be experienced to do the work properly. In grading the ditch bottom I use a sixteen-foot level built up so that the level part is above the ground convenient to both hand and eye. If the grade be as low as two or four inches to the 100 feet side readings must be taken every fifty feet. When the ditch is nearly done, a peg can be driven in the bottom of these points on which to place the staff, or a little earth can be dug out to the proper depth and the grading be done from point to point, using the sixteen-foot level to keep right between points. If the grade be from six inches up on a hundred feet, the sixteen-foot level is all that is necessary. If water is running, no level is necessary, but water makes a messy bottom, and the work will not be as accurate.

We have demonstrated to our own satisfaction, that a machine propelled by horse power which loosens up the dirt and throws it out of the ditch at the same time is a practical and economical method. The Cyclone Ditcher is the one referred to. It is operated with six or eight horses. If six, they must be good ones. They work on a fourteen-foot heavy evener, one team on either side of the ditch, outside of the dirt that is thrown out by the machine.

The machine has a long axle so that the carrying wheels are directly behind the teams. The cutter, which is similar to the one described in the Junior plow but heavier, is raised and lowered by a screw gear operated by the man on the seat, with a steering wheel in front of him. The ditch is dug by passing back and forth over it a number of times, or, better yet, by going up one ditch and coming back on another. thus saving short turning at the ends. The depth of each cut is regulated by the man at the wheel, according to the density of the soil and the strength of the teams. Two hundred rods can easily be dug in a day to a depth of from twenty-four to twenty-six inches, and in some instances even 300 rods, where the drains are laid out the whole length of the field. When a stone is encountered it has to be removed with a pick or bar by a man who follows the machine; then the loose dirt finally left in the bottom is thrown out with rounder scoops made for the purpose. To operate the machine requires two drivers, the man on the machine and the man that follows to remove stones. Where rocks are encountered, dynamite is used to remove them.

The expense of the machine is $250. It will pay for itself in one season's work, and there is practically no wear on the machine excepting in the cutter, which is easily replaced. By its use a field can be finished up quickly and in time to get the crop planted in season. In steam or gasoline driven machines, the Buckeye takes the lead. The machines cost from $1,500 to $2,500, can dig four feet deep and fourteen inches wide, with the larger machines completing the ditch by once passing over it, so the tile can be laid directly behind the machine. The grade is kept accurate by targets or sights that are set along the line of the ditch. One hundred to one hundred and fifty rods can be dug in a day.

Now, as to the material in tile to be used. Formerly it was believed that porosity was essential in drain tile, that water might more readily enter the drain by filtering through the tiles. This theory has long since been proven fallacious, as the water enters at the joints. Tiles made of clay and burned are porous and often contains more or less of a lime deposit. When these pores fill with water and freezing occurs and the lime slacks, expansion occurs and the tiles are liable to crumble. You will notice that where clay tiles lay out exposed to water and freezing they often crumble. The hard burned Ohio shale tile are acknowledged to be the best for all purposes, although they may cost a little more. Are used for all lateral connections. All joints are fitted as close as possible.

A good outlet to a drainage system is of prime importance. If possible, have a drop at this point to allow of a free egress of water. The last six feet of an outlet should be sewerpipe, cemented at the joints to prevent the water seeping out under the tiles and eventually undermining the foundation. The outlet should be built up of concrete or stones laid in cement, with a foundation deep enough to prevent heaving and consequent breaking up.

A heavy galvanized door or floodgate should be placed over

the outlet opening. This is made by taking a piece of heavy galvanized sheet iron large enough to cover that opening when bent double, and riveting these together, a piece is cut out of the center where it doubled over and a long pin or small cord is passed through. Then another piece, but narrower, is doubled over and united in the same way. This is the top and is built into the concrete on top of the tile. In fact it is built like a big hinge. It is self acting, remaining close over the opening when no water is running to prevent animals from entering, and raising and floating to the stream that flows from the drain.

If there be any place in a drainage system where there is scant fall, let the least fall be near the outlet on the main line, and have the greatest fall in the smaller laterals, as they are more likely to fill up, where in the main where the stream is strong it keeps scoured out and clear.

Another strong point is to have as few outlets as possible, as one strong current from a big outlet will always clear itself, where a small outlet with feeble flow would become clogged. Where quicksand is encountered, in drainage work, a board should be placed on the bottom of the ditch for the tile to lay on. Breaking joints of tiles over joints of the boards. Cyprus is preferable. Then fill in with surface soil all around and over the tiles. This, if properly attended to will prevent all trouble from this source. In fact it is always best to place the surface soil directly over the tiles in all kinds of soil. Don't put clay directly over the tiles. It lacks porosity and retards drainage.

It is often practicable to let the water directly into a drain instead of allowing it to filter through the soil, especially in basin drainage. There are two ways of doing this. One is to leave an open pit over the tile at a convenient point. The sides of this should be lined with plank or cement with the top extending from four to six inches above the surrounding ground. This pit can be filled with cobblestones to the top, and rounded up. Now the heavy material in the water will settle outside the pit, while the straws and trash will land on top of the stones. What little silt gets into the drain is carried through with the rush of water. Another way is to place a large sewer pipe with bell end up, down to the tile in which an opening has been left, as in the stone intake, to admit the water. Then a screen is placed in the upper or bell end of the sewer pipe, this too extends above the surrounding ground. While these methods are admissible under certain conditions, and for special purposes, they are not recommended for general use, as all surface water should naturally filter through the soil, leaving there its fertilizing material and entering the drain practically pure water, whereas, with the open intake, the fertility rushes away with the direct flow, basin tracts and low land are rapidly filling up with the annual accumulation of silt that comes down with the runoff from a watershed. When the soil is under cultivation and loose, as well as during sudden thaws in the spring when the ground is thawed out

for an inch or so in depth, and the snow water passes off rapidly, this filling up is augmented.

In case there is a low wet spot that is to be drained, don't run directly through its center, but skirt its upper side, capturing the water before it gets to the low point and getting better depth for the drain. A friend of mine had done some drainage on his farm. He had run the line of tiles up through the center of a hollow. He wanted to know why the slope above was still wet, and why, when he dug test holes in the ground a short distance from the drain up the slope, they filled up with water. I told him that if the drain was at the upper edge of this slope and fairly deep it would dry both slope and hollow. And it always does. In running a drain up through a gully, have it, if possible, a little to one side of the old water course, for the dirt that has been dug out and replaced is always loose and surface water runoff will soon cause erosion that will eat its way right down to the tiles. It is best in such case to plow down from either side until the center is raised so much that the surface water will be divided and pass along the sides.

The cost of ordinary drainage per acre, that is, under average conditions, with hand labor and placing the laterals three rods apart, would be from $40 to $45. By using the plow as I have described earlier in this paper, the labor can be materially reduced, and when the Cyclone Ditcher is used the expense or initial investment in drainage is reduced by half.

No man who understands the great mechanical and chemical change that occurs in the soil after drainage can ever say that he cannot afford the expense, for it is not an expense at all, but an investment—and a better one is hard to find. The man who is progressive enough to drain his land usually follows up the work by thorough preparation of his fields for cropping, and in using the necessary fertilizers. He now gets bigger crops, more hay and other fodder and grains. This means more stock, and this is followed by more manure for fertilizer, etc., etc. He has worked into a kind of circle that under wise management, never grows less. In the orchard, tile drainage means more and larger fruit of better color and quality, and this gives the orchard a reputation, a point of utmost importance to the fruit grower.

The present prices for drain tile delivered at Geneseo are 3 inch $17.60; 4 inch $24.50; 6 inch $50.75; and 8 inch $74.70.

Wet land is the poor man's opportunity, and the rich man's spoil. Past generations have been leaving the annually increasing supply of plant food in the soil and this is now a valuable asset to the present owner. Will he avail himself of it?

The earth fresh from a wise Creator's lavish hand was perfect.

Here man was given charge that he by proper methods should the elements develop and combine that sustenance might be provided for generations to come.

I will tell you to-morrow of some great contrasts in crop production from the same land, before and after drainage.

Thanking you for your close and respectful attention, I am ready to attempt to answer questions.

Corn Growing and Improvement.

PROF. FRANK D. GARDNER, *Department of Agronomy, Pennsylvania State College.*

An average acre of corn in Pennsylvania produces more food value than an equal area of any other staple crop, excepting potatoes. Corn fits into our rotation without conflicting very seriously with other crops for labor for men and teams. It has a wide range of adaptation, so far as soil is concerned. It has a long growing season, and therefore, fully occupies the soil and utilizes the plant foods which become available throughout the season of plant growth. These are some reasons why corn is a good crop to grow in Pennsylvania. When we compare the production of corn per acre between the corn growing states and Pennsylvania, we find that corn in Pennsylvania gives us on an average better yields than it does in the grain growing states where corn is the dominant crop. When we compare the cost of production and returns per acre in Pennsylvania with oats, wheat and hay, we find that corn gives a larger net return per acre, and the chart which I have here bears directly upon these facts. In the year 1909 the Bureau of Statistics of the United States Department of Agriculture secured from all over the United States a large number of careful estimates on the cost of producing crops. These were tabulated and reported in the Crop Reports 1911. As a result of between three and four careful estimates in Pennsylvania where all items under cost of production have been taken into account, we get facts as summarized in Table I which follows:

Table I.—Cost of Production and Profit per Acre on Staple Crops.

	Pennsylvania			N. Atl. States
	Oats	Wheat	Corn	Potatoes
Value of Land,	$60.15	$62.38	$62.00	$62.07
Yield per Acre,	35.6 bu.	19.8 bu.	41.7 bu.	138.0 bu.
Value per Bu.,	$ .48	$ 1.02	$ .69	$ .53
Value Grain per A.,	17.21	20.10	28.77	
Value by-products,	3.34	3.87	4.25	
Total Value,	20.55	23.97	32.02	73.14
Total Cost,	13.89	16.68	17.93	38.82
Profit per A.,	6.66	7.29	15.09	34.32
	(1909 crop)		Crop Reporter 1911.	

No report of the cost of production of potatoes in Pennsylvania is given, but we do have the cost for the North Atlantic states. It is probably not much different from the cost in Pennsylvania. It costs a little more to produce an acre of corn than to produce an acre of wheat or oats. The table shows a profit of $6.66 an acre

for oats, $7.29 for wheat, and $15.09 in the case of corn, which shows up decidedly in favor of corn, so far as profits are concerned. I give you these figures to emphasize the statement that I made in the very beginning—we should increase the acreage of corn rather than diminish it.

If it is true that we should increase the acreage rather than otherwise, the next question is how can we improve the corn along with the increased acreage. The first thing that the farmer needs to do, especially if he is not well provided with his own seed corn, is to secure new seed. Many Pennsylvania farmers have sent far away for seed corn, frequently sending out into the corn belt, and as a rule, have been very much disappointed with the result. It is generally much better to secure seed of a reliable grower who grows it not too far away and under soil and climatic conditions that are similar to those on which you expect to grow the crop. If you secure good seed grown under such conditions the chances are that you will not be disappointed in it. It is generally best to purchase seed corn in the ear, so that you can see if it is as represented to be in regard to type and uniformity and all of the ear characteristics.

After having the best seed that it is possible to start with, the next step is to improve that seed and make it still more desirable for the locality. This brings us to the question of seed selection—how to select seed and what kind of seed to select under your conditions to improve that corn and make it more productive. The chart before you shows the result of two methods of selection; that is, selection from the plant in the field as compared with selection after the corn is husked. It is easier to select fine ears of corn from the corn after it is husked than it is to go out in the field and make the selection there, but we lose in our effort to improve corn by selecting in the former way, because we can see only the ears and cannot see the stalks on which they grow, nor the conditions under which they grew. We do not know whether the good ear of corn came from a stalk that stood out by itself on a spot that was unusually fertile and consequently was large, or whether it came from a hill where there were two or three stalks under normal conditions; but if we select it in the field then we do. In that case we avoid selecting ears from stalks especially favored, because from such a selection we are uncertain whether the quality we see is inherent in the plant, or whether it is simply due to favorable conditions. If we are selecting in the field, and select fine ears under normal conditions, then we have reason to hope those ears will prove to be larger and better producers than those with which they come into competition.

Table II.—Plant versus Ordinary Selection of Seed Corn.

Ordinary,	68.64 bu.	
Plant,		76.57 bu.
Ordinary,	68.53 bu.	
Plant,		70.56 bu.

Ordinary,	69.07 bu.	
Plant,		71.43 bu.
Ordinary,	70.83 bu.	
Plant,		71.43 bu.
Average for Plant Selection,		72.49 bu.
Average for Ordinary Selection,		69.23 bu.
Gain for Plant Selection,		3.23 bu.

O. A. E. S.

The results in Table II are not Pennsylvania figures, but come from the Ohio Experiment Station. In the ordinary selection we have in each comparison a lower yield than in plant selection. When we take an average we have an increase in yield of 3.25 bushels per acre in favor of selection from the plant, showing that there was some inherent power in the ears selected under normal conditions, which were good ears, and they had a tendency to produce more corn than equally good ears selected without that knowledge.

Table III.—Influence of Previous Environment on Corn Yields.

Yields when Grown Three Stalks per Hill.	Previous Condition of Growth. Plants per Hill.			
	1906	1907	1908	Ave.
1	64.5	65.3	55.8	61.8
2	66.0	66.1	54.6	62.2
3	70.3	67.1	55.6	64.4

Nebraska.

We have here another chart showing the influence of the thing I have been speaking about, that is the environment. We have here an instance in which corn was planted at the rate of one, two and three kernels to the hill, seed being selected from each of these three plots of corn, and the seed was planted for three succeeding years afterward, of course selecting each year the best ears that were available for the following year's planting. For the first year the yield of corn from seed selected from plat having one stalk to the hill was 64.5 bushels per acre. From two stalks per hill it was 66 bushels per acre, and in the case of three stalks to the hill it was 70.3 bushels per acre. What does this mean? It means simply this, that the good ears selected where the corn was planted at the usual rate of planting were inherently good; those from one stalk per hill were good chiefly because of favorable conditions. As it was followed up, planting good corn from each one of these lots, each year the difference seemed to diminish, and in the third year there is practically no difference.

In selecting corn we need, first, to have the type in mind, just as we do in selecting apples, Jersey cows or a certain breed of swine. We should have in mind certain characteristics that are typical. That type is presumed to be the best of its kind. For medium maturing dent corn the stalks should be 8, 9, and perhaps, 10 feet in height; the ears should be borne at a height of approxi-

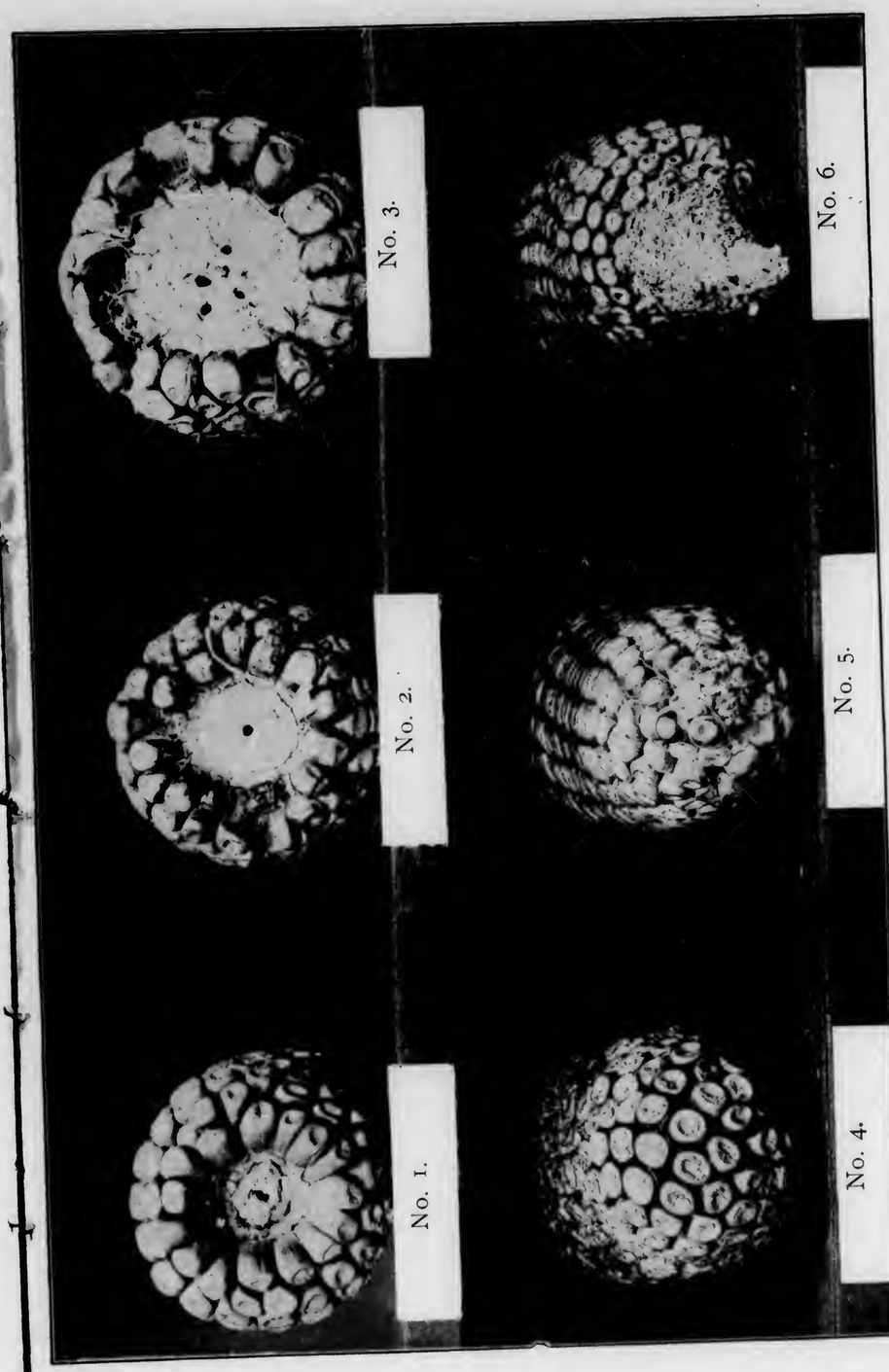

PLATE I.—Good and inferior butts and tips. No. 1, good butt, but shank is too small. No. 2, good butt and shank proper size. No. 3, poor butt, cob large, kernels shallow and shank too large. No. 4, well-filled tip. No. 5, good tip. No. 6, poor tip with too much uncovered cob.

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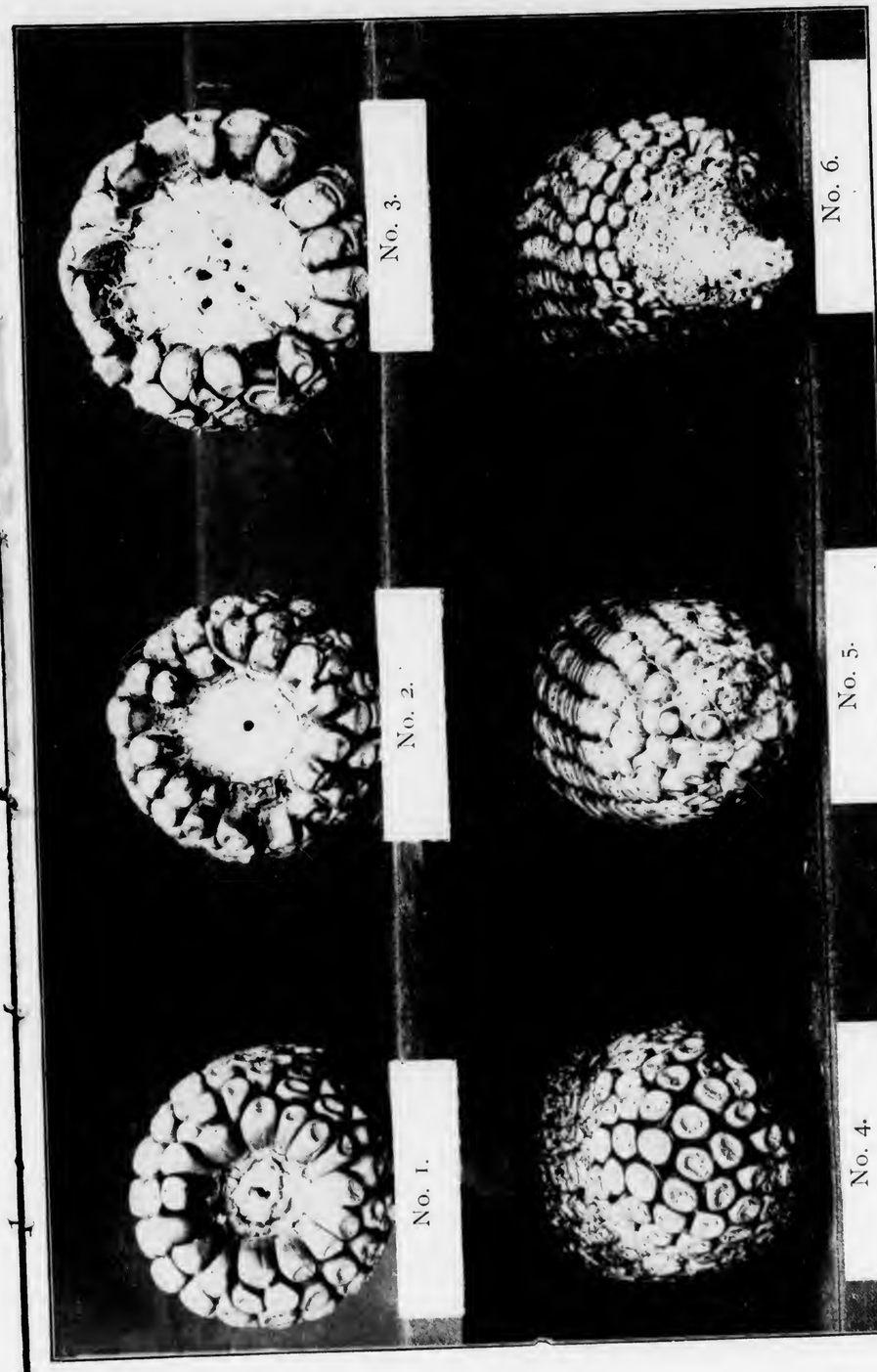

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mately four feet, and should be attached to the stalk by shanks that are neither too long, too short, too large or too small. A short shank is inclined to keep the ears too erect, and there will be a tendency for the rain to get into the tip and cause damage to the corn.

If husking corn standing in the field, the average husker would prefer ears that are on shanks of medium length and not too large. Ears on such shanks break off more readily than if the shank is too large. The stalks, of course, should be free from any diseases, such as smut or rust. Diseased plants are less resistant than those free from disease. The nodes should be short, for at each node a leaf is borne. The more leaves the greater power of the plant to convert the elements of air and soil into corn. Furthermore, when we use the plant as a by-product, the leaves are the most palatable and nutritious part of the plant, consequently the value of the by-product is thereby increased.

The ears should be cylindrical in shape, with well filled tips and butts. For a medium maturing variety of dent corn ears from eight to ten inches long are good size. An ear ten inches long should be about seven and one-half to eight inches in circumference, two-fifths the distance from butt to tip. The kernels of such an ear should have a depth equal to one-half the diameter of the cob: in other words, if the cob is broken in cross section and kernels on opposite sides are tipped over, the crowns of the kernel should meet at the middle of the cob. This chart will probably help us in our discussion of the character of kernels we should find in a good ear. (Chart omitted from report.)

Here we have kernels that are undesirable because they are sharp-pointed and weak, and do not fully occupy the space around the cob. Here are kernels much better in form because they fully occupy the space around the cob, and also because the tips are full and strong, thus indicating vitality and high feeding qualities. Here we have kernels that are too shallow or too short. An ear of that character would not shell out a high per cent. of kernels. Looking at the kernels from the edges, we frequently find spaces between the kernels in the row, which is also undesirable.

The largest percentage of protein lies in the embryo of the kernel. When the embryo extends well up into the crown we know such kernels have more protein than those that have a small embryo. When used as a stock food we have to supplement corn with foods that are higher in protein. The protein content of corn is therefore important from the feeding standpoint. The hardness of the kernel is also an indication of protein content. The hard kernels are a little higher in protein than those that are soft and starchy. Furthermore, the embryo is rich in fat, and fat is a little more valuable weight for weight than starch.

So much for the characteristics of the corn. When we have made a selection of choice seed ears from good strains, we should then take good care of it. It should be stored where it will become thoroughly dry before cold weather comes on and should be protected from the ravages of rats and mice. If corn is thoroughly dried before cold weather comes it will stand a very low temperature without being injured. Temperature that will cause freezing of the water in the kernel will injure or lower its vitality and may wholly destroy its germinating power, depending on the amount of water present. We have had, during the past month, weather conditions that were not favorable to drying corn, and while we have not had very cold weather, if we should have very cold weather coming on suddenly, seed corn that has not been very well taken care of may be seriously injured.

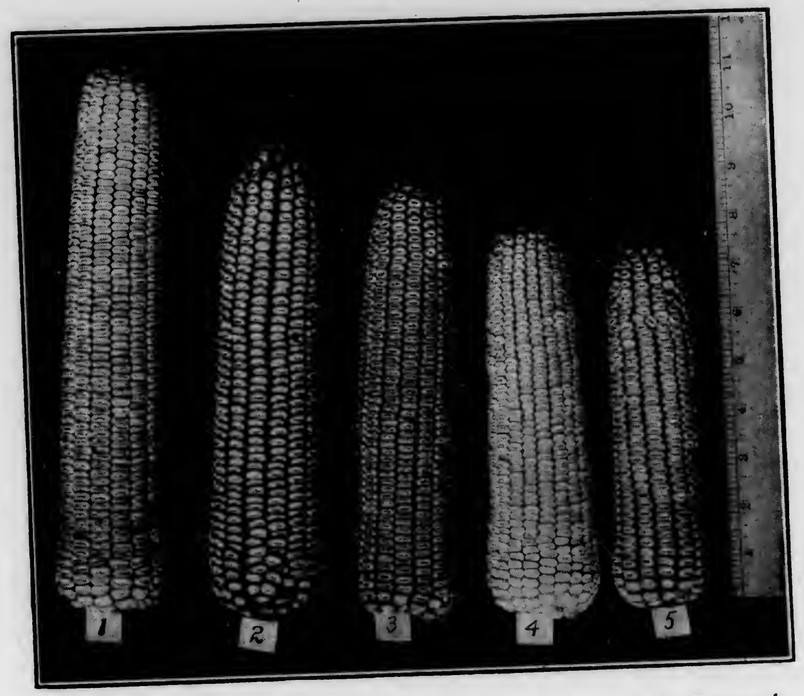

PLATE II.—Typical varieties of dent corn grown in Pennsylvania: 1. Southeastern Pennsylvania, White Cap Dent. 2. Southeastern Pennsylvania, Yellow Dent. 3. Southwestern Pennsylvania, Improved Leaming. 4. Central and Northern Pennsylvania, White Cap Dent. 5. Northern Pennsylvania, Early Huron Dent.

Table IV.—Effect of Method of Storage Upon Vitality of Seed Corn. Pa. 1912.

Stored	No. of Lots	Average Per cent. Germinating
In Crib with Other Corn,	31	65.1
In Dwelling-House,	33	86.4
In Room with Heat,	12	89.6
In Out-Building,	45	84.2

Pa. Experiment Station.

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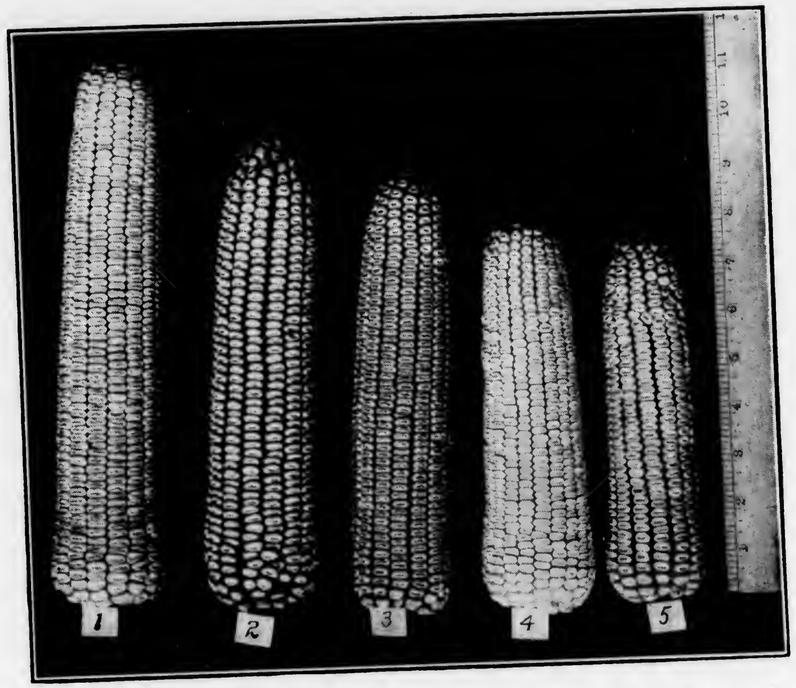

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Pa. Experiment Station.

Last year the Department which I represent sent to every county in the state of Pennsylvania letters of inquiry, sending them, so far as able, to men who are growing corn, and asking them to send us six kernels taken from each of 25 representative ears of their seed corn. Out of 250 to 260 inquires we had 150 replies and 130 samples of corn, so that nearly every county in the state was represented. We took those 25 samples from each locality and made a germination test of them. There were 31 men who sent in corn that was stored in the crib with other corn, the average germination of which was 65.1 per cent. too low to be suitable for seed corn. Of the lots which were in dwelling-houses there were thirty-three, and the average germination was 86.4 per cent. The lots stored in rooms with heat, numbered twelve only, and germinated 89.6 per cent. or nearly 90 per cent. That was the best seed corn that we found, that which was stored in houses where there was heat. That which was stored in outbuildings germinated 84.2 per cent. showing that the best germination took place where the seed corn had been cared for.

Table V.—Effect of Method of Storage Upon Vitality of Seed Corn. Pa. 1912.

Method of Storage.	No. of Lots.	No. of Lots in 100 with Per cent. Germination				
		91-100	81-90	71-80	51-70	Below 50
In Crib with other Corn,	31	13	16	19	23	29
In Dwelling-House,	33	61	18	9	9	3
With Heat,	13	62	15	15	8	0
Spread out in Out-Building,	45	40	29	18	9	4

Pa. Exp. Station.

On this table we have the results tabulated in a different way. In case of corn stored with heat there is one more sample than before. With corn that was stored in the crib, 13 out of 100 samples gave a germination of 91 to 100 per cent. This would be considered good seed corn. There were 16 out of 100 that gave a germination of 81 to 90 per cent.; 19 that gave a germination of 71 to 80 per cent., and 51 lots, or more than half of the corn thus stored that fell below 71 per cent. in germination.

Here is another chart showing result of experiments on the effect of warm and cold storage on seed corn and the yield that resulted from the two methods of storing. This is an experiment at our own Experiment Station, conducted for two years. During 1910 we had 80.6 bushels per acre from warm stored seed as compared with 76 bushels, where it was cold stored. An average of two years, gave 73 bushels per acre in one case and 68.8 in the other, a difference of 4.2 bushels per acre in favor of seed corn that had been stored where it was warm. We found that the corn that had been stored where it was warm germinated more quickly and gave more vigorous sprouts than that which had been stored where it was very cold, and probably that is the chief reason why we get a better yield.

Table VI.—Effect of Method of Storing Seed Upon Yield of Corn.

	Shelled Corn bu. per A.	Stover Lbs. per A.
Warm Stored Seed, 1910,	80.6	5436
Warm Stored Seed, 1911,	65.4	4369
Average,	73.0	4903
Cold Stored Seed, 1910,	76.4	3789
Cold Stored Seed, 1911,	61.1	3789
Average,	68.8	4471

Pa. Experiment Station.

C. J. Tyson. If that corn had been planted with a planter the usual distance there probably would have been a greater difference.

Prof. Gardner. There probably would have, although we did not find very much difference in the per cent. of germination. It was largely a question of vigor. The corn stored where it was cold was sufficiently dry before cold weather came on, so was not winter-killed but was weakened.

The importance of having a full stand of corn cannot be over-estimated, and few of us realize how far we fall short of having a full stand until we actually go into the field and make a count of the missing hills or missing plants. If 80 per cent. of a stand will give 40 to 45 bushels to the acre, what would 100 per cent. of a stand give? We at least ought to have 90 or 95 per cent. of a full stand of corn if we take the proper precautions, and the first step in securing that is the seed that we use. Seed, although well cared for, should be tested for germination before planting time, because we can never tell by inspection whether the seed is going to give a perfect germination or not. There is only one correct way to make a germination test of corn. It will not help you any to shell the corn and test the bulk seed. You cannot improve it after it is shelled and is all mixed together, so there is only one satisfactory way, and that is to test each ear separately and find out which ears are deficient in germination and discard them. In that way you eliminate the poor seed and improve the germination of the seed you are going to use. This may seem like too much work, but when we go at it systematically 6 or 7 bushels of corn can be tested in a day by one man. A bushel plants 5 or 6 acres, so that it is not an expensive proposition. The way to do this is to have the seed corn ears laid out in a row, or if you store them on racks in rows it will not be necessary to remove them from the racks except to remove about five or six kernels from each ear, after which it is returned to the rock. Have small trays about 18 inches square and two and one-half or three inches deep of ordinary lumber. Fill these trays about two-thirds full of wet clean saw-dust, loam or sand. Take a piece of muslin as wide as the tray and twice as long and rule off one-half into checks, preferably making ten checks to the eighteen inches, one and three-quarters to each check. That will give you just 100 checks in the tray. Number those and then put the six kernels

taken from ear No. 1, in check No. 1, etc. When all checks are filled fold the blank end of the muslin over the corn and cover with a wet bag or saw dust. Keep in a warm place for five or six days.

The germination test will show which ears to discard. There are three requisites necessary for germination—moisture, air and the proper temperature. The temperature of the ordinary living-room, provided it is not lower than 50 at night, is favorable for germination of corn. You will need to provide the necessary moisture to complete the germination. Where the temperature runs about 70 degrees, in five or six days the corn will have germinated sufficiently for you to make examination and ascertain if any ears are not giving satisfactory germination. Then with a little pad and pencil go over these trays of corn and make a memorandum of all numbers that do not give full germination. You may sometimes be justified in saving an ear where only five of the six kernels germinate, but ordinarily we will not do that. It is better to discard every ear that does not give us full germination.

If the corn is not uniform in regard to size of kernel it is well to grade it. You should also remove the tip and butt kernels of the ears before shelling for the planter. Now and then the tip kernels, in experimenting, have failed to come up to standard but we have quite a number of experiments where we have divided the ears into three parts, and have found as a rule, there was no difference in yield. Kernels, from the butts and tips of ears, being irregular in shape, do not go through the planter uniformly and for that reason are discarded.

If the corn is lacking in uniformity of kernels it should be graded. Divide the ears before you shell them, placing ears with large kernels in one pile and those with smaller kernels in another pile. By means of a corn grader we may also secure seed corn of a uniform size. One of the best graders I know is a little cylinder. The kernels drop out into three different compartments. The tip kernels will drop out into first compartment and be rejected. The butt kernels will pass out the further end of cylinders and also be rejected.

After having your seed corn tested and graded the next step is to get a good stand. You may ask what is a good stand of corn. Of course it will differ with soil conditions and the nature of season. On fertile soil we can grow a few more plants than where the soil is not so fertile, but on an average you should strive to get about 10,000 plants to the acre, properly distributed. One kernel every fourteen inches in the row, or three kernels every forty-two inches makes practically no difference in yield. In some cases a little increase in yield in favor of the drilled corn has been reported. When planted in hills and checks we can cultivate both ways in order to eliminate the weeds. If we are growing it for fodder or ensilage purposes we may plant it one-fourth thicker than if planted for grain.

Table VII.—Relation of Stand to Yield.

Drilled 42 in. by 14 in. between Stalks in Row.
Hills, 42 in. by 42 in. 3 Stalks per Hill.
Number of Plants per Acre—10,665.
1 lb. Ear to the Stalk, Perfect Stand, 152.4 bu.
1 lb. Ear to the Stalk, 80% Stand, 121.9 bu.
¾ lb. Ear to the Stalk, 80% Stand, 91.5 bu.
½ lb. Ear to the Stalk, 80% Stand, 60.9 bu.
4.9 oz. Ear to the Stalk, 80% Stand, 36.8 bu.

Penn. State.

Should we have corn planted in drills 42 inches apart with 14 inches between the stalks or planted three kernels to the hill with hills 42 inches apart, the number of plants per acre would be 10,665. If we secured a one-pound ear, and that would not be excessive, on each stalk, this would give a yield of 152.4 bushels per acre. If we had only 80 per cent. of a stand and had one pound ears we would have 121.9 bushels per acre. When we take the average yield of corn in Pennsylvania, 36.8 bushles per acre it seems that the average weight of ears is 4.9 ounces, so it is not necessary to grow big ears to produce a good yield provided we have a full stand. Some of our farmers go too far in that direction, trying to grow a variety of corn with great big ears, and consequently many times their corn does not mature and their seed corn is a failure. They may also frequently have corn of poor quality. So much then for the question of the improvement of corn, and selecting and testing of seed and securing a full stand in the field. This is something every farmer can do, but it is not necessary where corn is not extensively grown for every farmer to go to all this trouble, but there should be a few in every neighborhood who are interested in the improvement of corn to supply their neighbors. A bushel of seed will plant about six acres and if it is superior in quality it should command a price of three to five dollars per bushel.

When it comes to the question of improving corn by breeding it is first and foremost a question of finding out what ears or strains have inherent in them the power of producing larger yields and perhaps a better quality of corn. The only way we can do this is to test under field conditions the choice ears. Suppose, for example, we select 100 choice ears of seed corn, as a basis for improvement. We will need to plant each ear in a separate row in order to observe its performance. Now instead of planting the full ear and losing all that seed, we will plant a portion of it. Suppose we use 200 kernels. An ear has 800 to 1,000 kernels on it. Plant those 200 kernels in a separate row. Make notes during the growing season relative to the character of plants in each row and their freedom from disease, etc. At the close of the season harvest each row separately and determine yield of corn and note character and quality. This test shows which ears were superior. Save the remnants of ears which produced 10 to 15 of the best rows. The following year these remnants may be shelled together and

planted in a patch by itself as a source of seed for the general crop the following year.

C. J. Tyson. What do you think of the advisability of selecting for two ears on a stalk?

Prof. Gardner. Under certain conditions, especially on the sandy soils of the south, two-eared strains are thought superior. In the corn growing states and in Pennsylvania such strains have no advantages. Yields have been, no larger than with single eared varieties. It requires more time to husk two small ears than one large one. Unless increased yield can be secured such strains have no advantage.

C. J. Tyson. In attempting to make a selection of the plants is there any indication you can go by without actually husking the ear?

Prof. Gardner. You cannot see the characteristics of the ear of course without removing the husk. If corn is a little too late we will select from the early ripening stalks, or if it ripens unnecessarily early, then we will select from stalks late in maturity. Such characters are visible without husking the ear.

R. M. Eldon. Could we help the corn by removing the tassels of the weak stalks?

Prof. Gardner. Yes, undoubtedly. If we find barren stalks in the field I believe it would pay to remove the tassels from those stalks. This removing of tassels is also another factor which comes in to the breeding problem, that of cross-pollenation.

R. M. Eldon. Could we grow Flint corn in this County?

Prof. Gardner. Yes, but the advisability of growing flint corn depends upon locality and length of season. In the northern counties I believe the Flint is the most profitable to grow. Unless the yields are larger there is little in favor of flint corn. With long growing seasons, dent varieties generally yield best.

R. M. Eldon. Is there any difference in the color, that is, any difference in the amount of protein of the different kinds of corn?

Prof. Gardner. No, there is not. When comparing the analyses many samples, there is no difference; they average up about the same. In certain localities where the season is not very long the yellow may have a little more protein than the white, or the flint may be a very little higher in protein than dent corn.

C. J. Tyson. The white varieties are usually the longer season varieties?

Prof. Gardner. As a rule, yes. The white varieties have dominated in the South, the yellow varieties in the North.

R. M. Eldon. You would not advise getting seed corn from Ohio, for instance, to be planted in southern Pennsylvania?

Prof. Gardner. That will depend upon your knowledge of localities. If in the same latitude and similar soil it might be all right, but generally your chances are best in getting corn nearby.

R. M. Eldon. A number of us would appreciate knowing the names and addresses of men in the same latitude as this locality.

E. C. Tyson. If you will kindly give me this list it will be published with the Proceedings.

A New Method of Developing and Utilizing Water from Springs and Streams for Farm Use in Connection With Agricultural Drainage.

HENRY T. COX, *Consulting Engineer on Farm Drainage, Geneseo, N. Y.*

I have been very much interested in Professor Gardner's address on corn, having done some experimenting along this line myself, in the way of improving the crop by seed selections. We are reminded that back of the crop is the seed, back of the seed is the soil, back of the soil is the man, and back of the man is the Creator.

Drainage is the foundation of successful crop production. My work has led me into a good deal of experience along that line. And it is my wish that some of this experience may prove of help to you.

I will outline a little as to how I became interested in this work which has led up to that feature heading this address.

At the age of twenty-five, I married the only daughter of a farmer, having previously prepared a home about two miles away. Her parents concluded that this was too far, and that there was land enough in the home farm for all. There were forty acres at one end of this farm, which because so much of it was wet and part swampy, it had been used mostly for pasturing. Father B. thought that from my previous experience on my Father's farm, I could make good land of this. The first year's crops were very poor, so poor, that when the threshers came to thresh out my little stacks of oats and wheat, (for the barns had not yet been built), they charged me by the job. They would not thresh as for others, by the bushel. I want to say right here, that such land is the "poor man's opportunity and the rich man's spoil." We often fail to realize this until it is too late. If we want to do something in this life to be remembered by, we want to do it for posterity, and I do not know where this can be better accomplished than by improving soil conditions. I told this thresher that I was going to raise just as good crops as my neighbors, and he would not get the job of threshing. After drainage, this tract of land proved the most productive in that section. It was a tough proposition, as there was poor outlet, and a large water shed to take care of. After outgrowing this place, a larger farm which had already been drained by the former owner was purchased, which because of a breakdown in my health, is now under tenant management, and I am devoting my time to the drainage and water supply problems.

Referring to the map before you, I want to tell you a little about the crops on this farm before and after drainage. This basin lot for instance, was previously waste land. After drainage,

the first crop which was beans, was so heavy that it paid the whole cost of reclamation. And since that, there have been grown on that field, two of the heaviest crops of ensilage corn that I ever saw grown anywhere. The land is improving every year. Many other fields have as good a record, and the springs are harnessed up to a useful purpose. This map represents the drainage and springs developed up to two years ago.

I now want to tell you about the springs. In the first place, "why and what is a spring." We may have found water bubbling out of the ground, but really we have just found where the subtranian stream has met an impossible barrier, and is forced up to the surface. This has been going on for so long a period of years that there is a greater or less area of swale and muck caused by decay of the rank growths, natural to such conditions. If we trace a spring to its source, we may have far to go. It may have its origin at the foot of some mountain range or from the seepage from lake or river. Wherever its source may be, the water percolates down through the ground until it encounters a layer or strata of gravel or other water bearing material. This is always underlaid with an impervious sub-strattum in its course it may meet with obstructions which will cause it to seek a channel to the right or left, or rise above the obstruction, thereby refilling the back reservoirs, then continuing on, it may encounter a seam or fault in the underlying sub-strattum, which causes it to seek a new level. But its course is ever onward until it meets an obstruction that causes it to rise to the surface of the ground; and we have the spring. The spring is there because the barrier to its further progress was there. And right in this clay or hard pan barrier is where I place this spring developer or pipe and the tile connection with over-flow all underground, a model of which I have here. By its use, the water can be carried in a pipe along down to where it is needed for farm use. It is often difficult to locate the exact spot where the real spring or springs are, where the swampy tract is quite large. This is done by running a drain across the foot of the tract and carrying this to a good outlet. Then by extending short laterals from this main up across the tract beginning at one side and placing these drains twenty feet apart, it is an easy matter to locate the source of the water when it is diverted from this point to a point where it can be utilized, two very important things have been accomplished. First, a valuable asset has been added to the property by the water supply, and second, the field has been doubled in value, by now being tillable over the whole surface. By this method of developing springs there is no cistern in the field as is so often the custom. Where ever I have found these reservoirs in use, I have found lizards and other creeping things in the water, and often silt and other undesirable material will find its way in. These conditions cannot exist where the developer I have shown you is employed. I will try and describe this device, which when once installed, is self regulating, perpetual and sanitary. We will follow the main

trench that runs across the foot of the tract and on up to and through the spring. Trenches are dug and tiles are laid in these as far as there are indications of water rising from beneath, these all converge at a point in the impervious barrier that has caused the spring to break out at that point. At this point a length of sewer pipe is placed, having a Y. The Y. turned off to one side at about a forty-five degree angle. This is the over-flow. The iron service pipe enters the end of the sewer pipe through a copper plate against which clay is placed so firmly that all water coming down from the spring to this point must enter the iron pipe. From the overflow Y. a line of tiles is laid bending down until it is on the level with the iron pipe at the bottom of the trench. This overflow is so placed that if at any time the water comes faster from the spring than the pipe can take it, it backs up and passes off through this Y. and into the regular farm drainage system. It is best to build a cement slab or square over the spot where the developer is buried, and also to have a cut-off at the pipe line at this point, so that at any time the water could be shut off entirely and all pass out by the over-flow. In the case of the spring shown on the map before you, the pipe line is over 3,000 feet in length, the reservoir is located above the barns at a little elevation, the fall from the spring to the reservoir is about sixteen feet, this small spring coming so far through a one-inch pipe supplies water for the large herd of cows kept at these dairy barns besides other stock. And the pasture fields are supplied with water from other springs as has been described. The windmill at the well has been taken down and the pumps are idle.

One large spring that I developed on another estate covers about two acres of land. The service pipe in this instance is two-inch and delivers under normal conditions, 10,000 gallons every twenty-four hours. The proprietor has erected extensive and expensive barns this past season and the water is to be piped through the buildings. This was the worst and the most difficult spring job that I ever encountered owing to sub-soil conditions and the large spring area, for it was all one vast spring. The surface is not yet dry enough to cultivate, but the water supply is invaluable. An undeveloped spring in a field is a detriment to the property. The same spring properly developed is a double asset. The field is now clear for cropping and the water supply is of great value. I have been in many sections where small running streams abound and cattle are allowed to wade in these to drink. This causes pollution of the water at all times and in the winter when in many localities cattle are driven to the stream to drink and they are liable to injury from slipping on ice that forms on the edge. If a trench is dug parallel to the stream and a short distance from it, coming up to the edge of the stream at the upper end and tile be laid in this, the upper end being filled in with stones to allow the water to enter. In this way the water can be switched off to one side in the tiles for a short distance then connect the iron pipe and carry it gradually in

the trench off to the high and dry ground farther down the stream, there it can come up into the tank which should have an over-flow connection with an underground tile drain which extends back to the stream again. This arrangement would give running water at all seasons, with no wet or muddy place at the tank where the stock comes to drink and it would never freeze in the coldest weather. In many instances water can be carried right into the buildings in this way by simple gravity, if not as in the case with some springs, the water can be delivered as near as possible to the buildings and a small gasoline engine be installed to pump it up. I have now told you of some of my experiences with springs, and without occupying further time, I am ready to try and answer questions that you may have in mind.

Mr. Eldon. If you were taking water to a building or a set of buildings, would you avoid all syphoning in the pipe? Did you use the same sized pipe, the whole length?

Mr. Cox. In this case, we did not, there was only one high point, and on this we placed a hydrant. We used larger pipes part of the way in one instance.

It would be better to use the larger pipe at the spring end.

R. S. Taylor. Do you leave the hydrant open all the time?

Mr. Cox. No, the hydrants are open along the line when water is needed, but the water runs continually in the pipe line. When we are back in the fields and want water to drink or for the horses, we open them.

G. G. Strong. When your barn is considerably higher than the spring, what is the best way to get the water to the barn?

Mr. Cox. If you have water enough to operate a ram, that is the most economical method. The Goulds people have a good ram.

G. W. Strong. How much fall is required to operate a ram?

Mr. Cox. Each foot of fall will raise the water ten feet. It takes considerable water to operate a ram so in most instances, a gasoline engine is the thing. One man over in New York on a large farm, had a great deal of trouble in getting a water supply for his stock and after spending much money drilling wells, finally had me come over and get levels on a water supply about two miles distant. There was plenty of water in evidence, but it was too far from the barns to be available. On the way home he said: "I want to drive down to the back end of my farm and show you some water I have there." About a mile from his buildings in a deep gully, was that same supply that we had seen up above, and right on his own farm. It had disappeared and come underground until it struck a rock barrier, when it came out again in this gully. He is now laying pipes to the buildings and will always have a good supply of water. A small engine will be used for pumping the water up.

Question. Do you notice any difference in your pipe summer and winter?

Mr. Cox. In the summer when the springs get low, air gets into the pipe, and when the water supply increases, this air gets imprisoned at the highest point and the hydrant has to be opened to let it out or there would be an air lock. As soon as the weather gets cold, we have no trouble all winter. The pipe line is about two and a half feet under ground.

Question. Are there any places on those high points allowed for ventilation?

Mr. Cox. Not at all of them. It is only necessary at the highest point. There is always air in water, and that air becomes separated under certain conditions and collects in these bends and sometimes the change of temperature in the soil allows it to separate more in some seasons than in others. It collects in these up bends in the pipes and we get a cut-off or air lock.

E. C. Tyson. How much fall would be required for the operation of a dynamo?

Mr. Cox. That I do not know. We have not experimented with that at all. Do not know anything about it. It would depend, I suppose, a good deal on the size of the dynamo and amount of water it would take to turn it.

E. C. Tyson. I thought perhaps you might have had some problems like that to solve.

Question. What kind of pipe do you use in your pipe lines?

Mr. Cox. The best galvanized iron pipes we can get. It is best to have the galvanized. When I had the pipes put in at my own farm we used black iron pipe, last fall when arranging for a dairy they came to this pipe and it was all gone. It had been there about twelve years.

Question. Were they steel or iron?

Mr. Cox. I understood they were iron pipe. The galvanized iron is the best. The steel pipe is a poor proposition. It is best to get the very best wrought iron pipe you can.

R. M. Eldon. I sent an inquiry to the *Scientific American,* asking about the probable life of black iron pipe in the soil, and the answer was if the water was pure it ought to last for fifty years.

Mr. Cox. Of course that has a good deal to do with it. Water laying around the pipe will corrode it.

R. M. Eldon. The surface water filled with decayed vegetable juices would attack the pipe outside.

R. M. Eldon. How large pipe would you use if you wanted convenient delivery at 1,000 or 1,200 feet, and would you use more than one-inch pipe?

Mr. Cox. We used an inch pipe over 3,000 feet. It was all the same size and it works all right.

R. Garretson. If you wanted to use a larger size pipe at the spring end, what size would you use in connection with the inch pipe?

Mr. Cox. That would vary, from 1¼ to 1½ would probably be enough. There is a rule to go by in that, but I never paid any

attention to it. The practical thing in our case is, we are getting the water by using the same sized pipe all the way.

R. Garretson. Do you think it might be possible if you start with the inch pipe, instead of putting the large pipe at the spring end, that it would increase the flow?

Mr. Cox. The large pipe is always used at the inflow end.

R. Garretson. That was something new to me. I heard an argument not long ago that if you used a larger pipe at the outflow it would increase your supply.

Mr. Cox. It gets away from the smaller pipe faster when the larger pipe is at the upper end. In drainage the reverse is the case. We did not change the size and are getting all the water that flows from the spring.

C. J. Tyson. I do not believe it would work that way. I think the reverse would be the case.

Mr. Cox. We get the best pipe from a firm in Buffalo. It is galvanized iron. There is a lot of difference in pipe.

Mr. Anderson. I do not think anybody can give the life of a pipe. It depends on the water that goes through it.

Prof. Gardner. Just a word in connection with what has been mentioned here. It has been found that bacteria causes a great deal of the rust of iron pipe, and it is not a chemical content of the water at all.

Mr. Cox. Now a word as to the shape and lasting qualities of tile. I believe a six sided tile preferable to the round tile. The round tile is liable to get a little out of place before the earth gets firmly settled around it. When you lay the six-sided tile, it is going to stay where you put it. If they are not hard burned, they are liable to crumble by frost actions.

E. C. Tyson. Wouldn't you find difficulty in making a good joint?

Mr. Cox. No, you have six chances to turn this and you can always find one side that will fit close.

J. W. Prickett. Do you close up the joints when you fill it?

Mr. Cox. Yes, and we put the top soil on first and keep the clay away from it. To take earth out and put it back again in the trench makes it porous, and draws the water readily into the drain.

A. W. Griest. What do you find is the cost per rod of digging with the ditching machine?

Mr. Cox. We have not gotten it down right to the cent. We have a great deal dug by hand and find that we get the cost down to less than half with the machine. They claim they can dig a ditch for six cents a rod, 300 rods a day or no sale. It can be done but we want to make a lot of allowance I think on their claim. When you have dug 200 rods a day you have done pretty good work.

C. J. Tyson. What depth do you have in mind when you are speaking of that?

Mr. Cox. The depth depends on the kind of soil you have to

drain, twenty-four to twenty-six inches. In the majority of our drainage in hard subsoil that is the depth we go, and some places a little shallower.

C. J. Tyson. Does the ditching machine work very well where the ground is soft and swampy?

Mr. Cox. It will not do as well under such conditions as big tractor machines with caterpillar tread. They can go through everything. The ground must be solid enough so that the teams can work. Six horses have to get right down to business on this machine and therefore cannot work in muck and mire. If the land is firm enough for horses to walk on, you can work the machine.

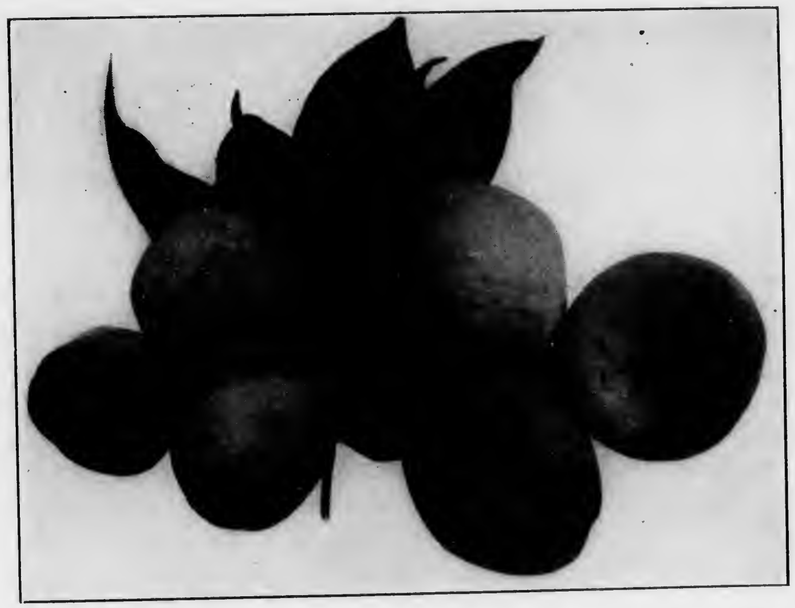

FIG. 7.—Average size specimens, from an unthinned peach tree (on the left) and from a tree thinned 4 inches apart (on the right).

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FIG. 7.—Average size specimens, from an unthinned peach tree (on the left) and from a tree thinned 4 inches apart (on the right).

Long Term Fertilizer Experiments at Pennsylvania Experiment Station.

PROF. FRANK D. GARDNER, *Department of Agronomy, Pennsylvania State College.*

Farming is a serious business and the farmer of to-day needs to be a combination of scientist, mechanic, laborer, and business man. There perhaps is no other calling which really calls for so much, so broad a training as that called for to be a successful farmer. We hear a great deal in these days about country uplift. How we should have better roads, and better schools, and better churches, and more conveniences in the home, and while these are all desirable things, I want to say to you there is an element of hot air in this talk we hear about it. We can get these things if we succeed in a sufficient degree, and I believe that as farmers we are glad and willing to have these things for our betterment just as rapidly as we can afford it. And in order to afford them it all hearkens back to the soil and to the business management of the farm.

Farming to-day is not all a matter of production, but it is also a matter of organizing the business of the farm and selling the produce of the farm.

At our Experiment Station we are fortunate enough to have organized an experiment which is to-day recognized as the longest continuous fertilizer experiment in America, and this experiment is to American agriculture what the famous Rothamsted experiments are to Great Britain's agriculture. This experiment was started by a man who is still active in experiment station and agricultural investigation work. I refer to Dr. W. H. Jordan, Director of the Geneva Experiment Station, N. Y. Dr. Jordan started this experiment in 1881. On several occasions it has been threatened with abandonment, but fortunately had tided over those threats and is still in existence, and I may say frankly to you there is no danger of its being abandoned now or at any time in the near future. It was my good fortune, during the summer of 1908, to attend the Graduate School of Agriculture at Ithaca, N. Y., where Director Hall delivered a course of lectures on the Experimental Works of the Rothamsted Station. In discussing the results of those experiments before a body of scientific men, among the many good things he said he made this remark "that if they had drawn conclusions from those field experiments at the close of thirty years, the conclusions would have been very different from the conclusions drawn at the close of sixty years." I think we are fortunate in having in Pennsylvania this experiment about which I am to tell you this afternoon.

The first chart gives you a little idea of the lay-out of these plats. There are 144 of them, each one-eighth of an acre in extent, so that the whole experiment included eighteen acres in plats, to

say nothing of the divisions between the plats and the waste lands about them. The plats are laid off into four tiers of 36 plats each. The crops planted on these plats are corn, oats, wheat and mixed timothy and clover, so arranged that each crop is represented every year. The results I shall present are for the first thirty years.

The fertilizers are applied to the corn and wheat, but not to the grass or oats. In other words, they are applied every other year. There are certain plats to which nothing has ever been applied, which are used as check plats, numbers 1, 8, 14, 24, and 36 in each one of the tiers, making 20 plats in all used as check plats and they have never had any fertilizer, manure or application of any kind.

Any fertilizer treatment that falls upon a particular plat falls likewise on the corresponding plat number of each one of the four tiers; and in several cases there are duplicate, and in one case quadruplicate plats in each tier; for example in case of the mineral fertilizers alone there are four different plats in each tier having identical treatments. The duplication of certain treatments, and having the four tiers covering so long a period of time gives averages which practically eliminate the errors that come in through individual years where some particular plats may not be quite up to standard.

The Soil.

The soil on which this experiment is conducted is a residual Hagerstown limestone soil varying in texture from a clay loam to a silt loam. The soil is well drained and yet the sub-soil is sufficiently heavy to retain both plant food and moisture very well. Leaching is reduced to a very low degree.

Table I.—Single Fertilizer Ingredient.

Alternate Years	Pounds	Value
None.		$60.02
Phosphoric Acid (P_2O_5), ...	48	69.05
Potash (K_2O), ...	100	56.05
Nitrogen (N), ...	24	55.94

Average Value of Products from 30 Years' Rotations. The Pennsylvania Experiment Station, State College, Pa.

Now, as I said, I shall speak of results as averages rather than in detail. The purpose of the experiment is, first, to compare the effects of individual or single fertilizer ingredients. I will speak of this before taking up the other points. On plats Nos. 2, 3, and 4, in each one of the tiers we have nitrogen, phosphoric acid and potash, used separately in the order named. Table I gives the rate of application and the value of four crops on one acre, as compared with the plats that had no treatment. In assigning values to the several products we have taken the December 1st price on these crops on the farms in Pennsylvania for a ten year period ending

1906. These prices assigned are as follows: Corn, 50 cents a bushel; wheat, 80 cents; oats, 32 cents; hay, $10 per ton, and straw and corn stover, $2.50 per ton.

Those are rather low prices compared with those that have prevailed for the past five or more years, and if we should take present prices our profits would be somewhat larger. We are therefore using very conservative figures in comparing the increase or profit of the several treatments. Notice that when nothing was applied a gross return of $60.02 per acre for four crops was secured. This represents an average for thirty years. Remember that there has been nothing whateve applied to that soil, not even the straw and corn stalks going back into the soil. Everything is taken off and nothing goes back. In the beginning the value of crops per rotation was $75, now it is down to less than $45. Now when we apply phosphoric acid alone we get a return of $69.05 per acre, or $9.03 more than when nothing was applied. Putting it in another way, we get a return of about 100 per cent. profit on the cost of the application, not counting the work or labor of applying. When we put potash on alone at the rate of 100 pounds K2O per acre, we actually had a smaller gross return than we had when we used nothing. In other words, it has not done a bit of good. The soil has not responded at all to potash. When we put on nitrogen at the rate of 24 pounds per acre every other year the same thing is true, our yield in fact is lower than when we used no fertilizer at all, and if we were to stop right now we would come to the conclusion that the soil needs only one thing, and that is phosphoric acid. At any rate, we seem safe in drawing the conclusion that the dominant fertilizer requirement of this soil is phosphoric acid:

Table II.—Two Fertilizer Ingredients.

Alternate Years	Value
None,	$60.02
P.,	69.05
P. & K.,	83.93
P. & N.,	78.38
N. & K.,	61.73
PK. & N.,	91.11

Average Value of Products from 30 Years' Rotations.

The Pennsylvania Experiment Station.

Proceeding further and looking into the returns from plats receiving two fertilizer constituents, we find that phosphorus which gave us a gross return of $69.05 per acre when combined with potash, gives a return of $83.93 per acre, or an increase of nearly $15.00 for the potash applied, which shows that as soon as we have met the soil requirement for one constituent then something else becomes a limiting factor for crop production, but potash is no good until we have applied phosphorus and satisfied the want for that. When we applied nitrogen with the phosphorus we got an increase, but not as large as we got with the potash. When we put the nitrogen and potash together and leave out the phosphorus we get just a little bit more than we got by using nothing, showing again that neither nitrogen nor potash will give any results on this soil until we have supplied the limiting factor, phosphorus.

It teaches us that this is a fact not only borne out on this soil, but shows how you must experiment on your soil to find out what your fertilizer requirements are. There are limestone soils in many parts of Pennsylvania, and we believe the results are applicable to practically all limestone soils. There is always a limiting factor in crop production. It need not necessarily be a plant food. It may be water, a lack of moisture, in which case the fertilizer will not amount to much, no matter how much is applied. It may be some other factor, such as want of lime or soil acidity. Some plats in this experiment have become so sour that crops fail, yet the soil is full of plant food in a soluble form, and as soon as we correct the acidity then those plats will become the most productive. Not long ago, a gentleman, speaking of how farmers had to contend with conditions that men of other occupations did not have, cited the fact that insufficient rainfall was often the cause of crop failure. He said he had a friend who had been having a good deal of trouble in growing potatoes, but that this Fall he had solved that problem by planting onions between the rows of potatoes. The onions made the eyes of the potatoes water so that he did not give a darn whether it rained or not.

Table III.—Different Forms and Amounts of Nitrogen.

Alternate Years	24 Llbs.	48 Lbs.	72 lbs.
Dried Blood,	$84.22	$90.57	$92.49
Nitrate of Soda,	91.11	93.73	94.75
Sulphate of Ammonia,	87.55	88.04	80.77

Average Value of Products from 30 Years' Rotations.
Pennsylvania Experiment Station, State College, Pa.

Now in addition to having the fertilizer element in different combinations, we have nitrogen in different forms and in different amounts. Nitrogen, as dried blood, sulphate of ammonia and nitrate of soda, has been used at the rate of 24, 48 and 72 pounds of nitrogen per acre. In other words, we have doubled and trebled the initial amount to see what the effect would be. At the same time we compare the benefits derived from different forms of nitrogen used in conjunction with the mineral fertilizers. Table III gives the average value of the products per acre received from the different forms of nitrogen used along with mineral fertilizers. We find that there is only a little difference, but the difference seems to be in favor of nitrate of soda. We, as users of fertilizers, are all familiar with this form, for it is perhaps more extensively used than any other form of nitrogen. Coming next to this we have, for the 24 pound application, sulphate of ammonia. Dried blood, seems to be a little less efficient than the other forms when used at

this rate. Comparing the 48 pound rate of application, dried blood ranks second, and sulphate of ammonia third. For the seventy-two pound rate of application, dried blood is far ahead of sulphate of ammonia. Why is the difference so great, and why do we get less return with this large application than we do with the lighter ones? In the beginning we did not, but it is a condition that has gradually come about. This form of nitrogen, sulphate of ammonia, causes the soil to become sour, and the soil of those plats treated with seventy-two pounds of sulphate of ammonia is now so sour that clover fails absolutely and red top and sorrel comes in and takes its place. Corn, wheat and oats, in case of the heavy application, are also failing, not absolutely, but they are very much reduced in yield.

In case of the forty-eight-pound application, clover has failed and the other crops are just beginning to show the effects of it. With twenty-four pounds of nitrogen the soil has not become sufficiently sour to prevent the growth of clover, showing that that is the reason that sulphate of ammonia in large applications has become so ineffective.

Table IV.—Commercial Fertilizers vs. Yard Manure.*

Alternate Years	Value	Cost Fert.	Increase Less Cost
None,	$60.02		
P.,	69.05	$ 4.80	$ 4.23
P. & K.,	83.93	12.80	11.11
P., K. & N.,	91.11	21.44	9.65
Yard Manure (6 Tons),	88.91	12.00	16.89

*Estimated at $1.00 per ton. Average value of products from 30 four-years' rotations. Pennsylvania Experiment Station, State College, Pa.

Table IV gives the comparative value of the crops from the several treatments, as follows: Nothing, $60.02; phosphoric acid, $69.05; mineral fertilizers, $83.93; complete fertilizer, $91.11, and barnyard manure, $88.91, the latter being a little less than we got with a complete commercial fertilizer. It is rather significant that we have been able during a period of thirty years, to more than maintain the fertility of this soil without the use of any manure. All crops—hay, stover, and straw—are removed and no crop residues returned.

The value of increase less cost of fertilizer treatment gives the following values. Phosphorus alone, $4.80; phosphorus and potash, $11.11; a complete fertilizer, $9.65, and barnyard manure, $16.89. Of course, in case of fertilizers, they are figured at what they actually cost. In the case of barnyard manure, it is necessary to attach some nominal value to it. In this case we have placed upon it a valuation of $1.00 per ton. This may be too low, but on the above basis we have for two applications, or $4.80 worth of phosphorus in the form of dissolved bone black, an increase above its cost amounting to 88 per cent. profit. In the case of mineral fertilizers the per cent. profit is 86, and with the complete fertilizers,

which cost $21.44, very much more than the other, because the nitrogen is the expensive ingredient, we get a profit of $9.65, or less than we had with the mineral fertilizer without nitrogen. This is only forty-five per cent., and if we are to draw any conclusions, it must be that it does not pay to apply nitrogen, at the rate of twenty-four pounds or more for these crops at the prices that we have received for them. If we had received fifty per cent. more for our hay, straw, wheat, oats and corn, it would add fifty per cent. to our profit, and we would probably be justified in using nitrogen.

Let me pause here just a minute to say that the amount of fertilizer you can use on any crop or any soil, depends, first and foremost, on the value of that crop. That is to say, if we get a 50 per cent. increase from a certain fertilizer that cost us a certain amount, we are justified in applying that to the soil in larger amounts for a valuable crop than we will for a crop that is low in price. For example, tobacco, which is worth 10 cents a pound, brings large returns per acre, so that we can use a larger amount of fertilizer per acre than we could for a crop of low value. This blue print (not reproduced in this report) gives us the results expressed graphically by five year periods. That is, here are represented the total yield in pounds of produce per acre for each four years' rotation. The open line represents the yields from untreated plot, and you will notice from five year period to five year period, that yield has been steadily going down. The dotted line represents the yields from phosphorus alone, and these also decline but not so rapidly as where nothing was applied.

After this experiment has been going on five or six years they seriously thought of abandoning it. Phosphorus gave no increase during those first five years, but since then has shown a marked effect. You will see as you proceed from five year period to five year period (represented by the diamond-shaped line), that we have been able to keep up the yield with phosphorus and potash. In other words, we have been maintaining the fertility of the soil for thirty years by use of the mineral constituents and without the use of nitrogen, but remember that this is a four years' rotation and includes clover once every four years, and that clover, like all legumes, has the power of getting all the nitrogen that is needed in this rotation. That is a very important thing for every farmer to bear in mind.

A man high up in counsels of soil fertility has made this statement: "The pressure of atmosphere on each square inch of the surface of the earth is 15 pounds. Four-fifths of that pressure, or twelve pounds, is due to the nitrogen in the air. At a conservative valuation of 15 cents per pound the nitrogen is worth about $11,000,000 per acre," and yet we pay 20 cents per pound for nitrogen to apply to our crops in the form of a fertilizer, when, in most cases, we should be getting it without cost.

Comparing the lines representing the complete fertilizers (rep-

resented by the squares) we find that we have not only maintained the soil fertility but have actually increased it. As we proceed from period to period the line gets higher and higher, giving us a total production of 20,000 pounds of produce to the acre in a rotation for the last five years, compared with 18,000 for the first five years. The yield from manure is represented by the white line which follows the preceding line very closely in the fifth period becoming a little higher, but in most cases falling a little behind.

Table V.—Light Application Yard Manure.

	None	Six Tons	Eight Tons	Ten Tons
1882-6, ...	$75.35	$87.03	$87.01	$85.56
1887-91, ...	75.46	91.67	90.56	90.00
1892-6, ...	64.29	91.46	90.64	92.75
1896-01, ...	49.16	83.07	85.93	90.54
1902-6, ...	50.88	91.73	93.95	100.67
1907-11, ...	44.98	88.52	89.54	96.58
1882-1911, ...	60.02	88.91	89.62	92.68

Where we have used six tons of barnyard manure we have a very uniform return. With eight tons of manure every other year, or sixteen tons in a rotation, we have increased the yield very slightly. With the larger application of ten tons every other year, we get a larger return on an average. Although we did not get a larger return the first five years, we have increased the fertility of the soil somewhat, for it is better now than it was in the beginning, as indicated by the larger average yield for the later period.

While we get a good increase, we do not get a sufficient increase to give us an equally good return on the unit of manure applied. In other words, when we apply six tons of manure our return per ton is considerably larger than when we apply eight or ten tons. In the case of the six-ton application, the return per ton has been $2.41; in the case of the eight ton application our return per ton has been $1.85, and with ten tons it has been $1.63. What does that mean for actual farm practice? Few farmers have enough manure to cover all their land, even once in a rotation. Good practice demands that the manure spreader be used, and the manure made to cover as large an acreage as possible.

There is another comparison that I do not have a chart to cover, and that is lime. Burnt lime has been applied at the rate of two tons per acre once in each rotation, and that is to the corn ground, and pulverized limestone applied at the same rate every other year to the corn and wheat. In the case of burnt lime we have not seen any increase in yield. In the case of limestone we have a small increase but no profit.

You may ask, what conclusions can we draw from the results of this fertilizer experiment, relative to the treatment of soils? Now then, we know that the potash used in this experiment is an unnecessarily large amount, and as a result of careful study, we have these suggestions to make; that in rotations, say of four years,

where you have corn, oats, wheat, clover, and timothy, each one year we would suggest that manure be used on the corn at the rate of six tons per acre, plowed under, and a commercial fertilizer used on the wheat.

Table VI.—A Seven Course Rotation.

Year	Crop	Fertilizer	Amount
1	Corn	Yard Manure	6 Tons
2	Corn	Yard Manure	6 Tons
3	Oats	Nothing	
4	Wheat	Acid Phosphate	350 Lbs.
		Muriate of Potash	100 Llbs.
5	Clover and Timothy	Nothing	
6	Timothy	Nitrate of Soda	150 Lbs.
		Acid Phosphate	150 Lbs.
		Muriate of Potash	50 Lbs.
7	Timothy	Nitrate of Soda	150 Lbs.
		Acid Phosphate	150 Lbs.
		Muriate of Potash	50 Lbs.

I realize that the question of soil fertility is fundamental, but, as I said in the beginning, is only part of the game. We know it is important to increase the production of our soil and take cognizance of the disposition of our crops and get what they are worth. We need also to recognize that the chief factors in the cost of production are the labor of men and teams and use of equipment, and that in order to make farming pay we must fully utilize these factors of production. We cannot afford to maintain horses on a farm at a cost of $130 a year each unless we better utilize them, or extend their work over a longer period of time. Many farmers, by a readjustment of the farm enterprises, could cultivate the same area of land with a less number of horses than they now use.

Now we hear a great deal about a little farm well tilled. It sounds very nice and reads well, but investigations seem to indicate that after all the important thing is the return per man rather than the return per acre. How much can you make as a farmer? How large does your farm need to be in order to make a reasonable labor income? A farm may be too small to make it possible to make it pay. The size will be determined chiefly by the kind or type of farming. The small farm has many disadvantages; disadvantages from the standpoint of small fields, which cost more per acre to cultivate and fence. The equipment and the buildings cost more per acre than on larger farms.

Question. What is the value of hydrated lime as compared with ordinary limestone?

Prof. Gardner. Hydrated lime is water-slaked or caustic lime. It is in a convenient form to handle, but the price of hydrated lime is always so high that we cannot recommend it for application to the land where other forms in equivalent amounts can be secured more cheaply. That seems to be the difficulty with hydrated lime. It is too high in price.

Question. What about the cost of raw phosphate as compared with acid phosphates?

Prof. Gardner. The cost is very much lower. I am sorry that we do not know a little more than we do about the relative merits, but we know that in some of the states where the soils are well supplied with organic matter, or where it is used in conjunction with green manure crops it is the cheapest source of phosphorus to use.

R. M. Eldon. Is ground limestone effective like burnt limestone?

Prof. Gardner. Yes, but in order to be equally effective it should be finely ground and thoroughly mixed with the soil.

Question. Is it equal to a ton of hydrated lime if finely ground?

Prof. Gardner. No, it is not. The ground limestone is carbonated lime and 100 pounds of that is equal to 74 pounds of hydrated lime, three-fourths as valuable. It must be finely ground in order to be as valuable. It is more agreeable to handle; it is not caustic. There is a great deal of interest in pulverized limestone, more and more of it being used. But the important thing is getting the lime on the land as cheaply as possible to correct the acidity of the soil. Lime may have other functions in the soil in which the caustic form may be more effective than the neutral or carbonate form, but the one thing that stands out is the correction of sourness of the soil, and I do not know of anything that can be used as cheaply as lime for this purpose.

Question. Is ground lime much easier to handle than burnt lime?

Prof. Gardner. It requires handling a larger weight of material to meet a definite need than would the other forms, but it is less disagreeable to handle than the caustic forms and can be spread with a lime spreader with less difficulty than air-slaked burnt lime.

Question. Suppose we tried to get the ground in condition for vetch and clover, would not ground limestone act as quickly and give as good results.

Prof. Gardner. It would. Now, let me tell you just what we have done. We have used the two in several hundred pots on very sour soil. We put the pulverized limestone and the caustic lime side by side ten days before putting in the clover, and the clover came up at once and made a good growth. We tested the soil for acidity at close of the test and found where the ground limestone had been applied in quantity just sufficient to meet the lime requirement, that we still had 28 per cent. of acid, that had not been satisfied, and with burnt limestone 29 per cent had not been satisfied. Of the original soil acidity 72 per cent. was corrected by ground limestone, and 71 per cent. corrected by caustic or burnt lime.

How Trees Grow.

PROF. C. R. ORTON, *Plant Pathologist, Department of Botany, Pennsylvania State College.*

Mr. Chairman, Ladies and Gentlemen: I feel greatly honored to-day in being invited by your Secreatry to speak before this Association of Fruit Growers not only because I know that it is a very active and wide awake organization but because this is the first opportunity I have had to address any public meeting of practical men since coming to this State in the early part of the present year.

The subject assigned to me for this address is not perhaps just what you might expect a plant pathologist to be most familiar with but let me assure you that the whole subject of plant diseases depends most fundamentally upon a thorough understanding of normal life processes of plants and so I may confidently say that this subject is of as vital importance to me as it is to you who gain a livelihood if not wealth from the fruit of the tree.

General. There are two ideas involved in plant growth; *increase in size* and the *formation of new organs*. In this discussion I shall try to bring out as clearly as possible the various steps by which a tree attainst these two forms of growth.

All plants have more or less definite periods of growth both in size and in form. These periods occur only once in the case of annual plants, twice in biennial plants which live two years, and year after year in perennials to which class our trees belong .

Phases: There are three recognized phases in the development of every plant whether annual, biennial, or perennial. The first may be called the formative phase; the second, the phase of enlargement and the third, the phase of maturity. Let us take up each phase separately and see how it develops.

Formative Phase.—This is the earliest phase. It finds its beginning in a group of cells in the seed. These cells divide many times during germination and from them are differentiated the three growing regions of our trees. These three regions are (1) the tips of stem and branches; (2) the tips of roots and (3), that portion of the tree just beneath the bark which botanists call the cambium.

From the growth of the tips of buds we get length or height of body and the spreading of the top by lateral branching. This is the most visible phase of growth.

From the tips of roots we get practically the same development under ground that we get above ground. These two forms of growth are very similar but physically the opposite as one is partially positive and the other negative to the force of gravity. There is also a peculiar sympathy between these widely separated grow-

ing points manifested by an adaptation of each to the needs or requirements of the other.

From those cells of the tree lying between the bark and wood we get the third formative phase o fgrowth. This phase which goes on periodically year after year results in increase in diameter of all woody parts of the tree. This growth is the result of one or two layers of cells (the cambium) dividing lengthwise, forming new wood on the inside and new bark on the outside. Everyone is familiar with the gross effect of this form of growth, namely, the annular rings seen in a transverse cut through a tree.

Phase of Enlargement.—As the new cells, formed by the division of previous existing cells in the growing points, grow older they enter upon the second growth phase—that of enlargement. In this period the last formed cells increase in size, sometimes a thousand fold but usually much less, especially in trees where the cells are of a woody nature. On examining these cells it is found that a large part of their contents is water, with a relatively small amount of living protoplasm lying adjacent to the walls. Hence we see that this condition necessitates a large amount of water available in the soil in order that the enlargement of cells may progress normally. A lack of water during the growing period results in dwarfing, a phenomena with which every fruit grower is familiar.

This phase of enlargement is not constant through the growing season. It starts slowly, gradually increasing in rapidity until it reaches a maximum and then gradually stops and comes to an end. It may last only a few days or may extend over a month or so, governed by conditions. This makes it extremely important that we conserve the food and water necessary for the tree during the growing season in order that this rate of growth shall be normal. The rate of growth during the period of enlargement varies greatly in different trees and under different conditions such as mentioned above. We all recognize that growth is much more rapid when trees are well nourished and properly cultivated to conserve the soil moisture. It, however, does not follow that rapid growth is to be desired in our fruit trees for it is often noted that trees which have undergone very rapid development are not so hardy as others which have developed more normally. We should aim for normal development in all cases for any deviation from normal development often results disastrously in the end.

Phase of Maturity.—We shall now consider very briefly the last phase of development in the tissues of a tree. This is the phase when enlargement of the cells has ceased. This condition is to be found in the heart wood of the tree which is composed of cells usually with thick walls, but containing no living matter (protoplasm). These cells remain in place and give much stability and strength to the tree but do not possess any life of their own. From the lumberman's point of view it is this portion of the tree which furnishes the most durable lumber and is consequently most sought for and most valuable.

Formation of New Organs.—This is the second idea involved in growth, the visible evidences of which are the production of new branches. The process of forming these new organs is somewhat similar in the roots to the process as it takes place in the top of the tree. These new organs arise from an actively growing point either in the cambium as in the case of new branches, or in the pith as in the case of new roots. At this point certain cells start active division in both planes which results finally in the forcing of such cells through the softer parent tissues to the surface where they appear as new buds or roots. From this point on their growth is exactly like previously existing organs.

The stimuli and conditions necessary to bring about the formation of new organs are similar to those of growth in general, which will now be discussed.

Conditions of Growth.—We are now ready to consider some of the more important conditions of growth. Perhaps the most important agent of growth, especially in enlargement, is water. Without water the cells of the three growing points cannot divide. This condition even if only temporary results in stunting of the tree as before mentioned. If this lack of water is prolonged, death may result.

The next most important condition is a sufficient supply of food materials which the tree uses for making new cells and the resulting tissue. These food materials are of a chemical nature. They are taken in by the roots, after being dissolved in soil water, and by the leaves in the form of gas (CO_2) from the atmosphere and made over into the living matter of the growing tissue or a portion of it may be stored in certain cells of the tree for future use. We call this last food, reserve, or storage food. It is made up largely of starches, sugars, fats and proteins. In other words, chemical compounds which are largely made up of carbon and hydrogen are manufactured by the plant within its own tissues and stored away until it is needed by the tree to mend broken tissue or to manufacture new tissues. Light is of the greatest importance in the manufacture of these food materials and will be considered later.

The third most important of the factors favorable to growth is oxygen. This element is obtained from the carbon dioxide in the air and is necessary in order that respiration and other vital processes within the tree may proceed without interruption. Growth in the absence of oxygen is practically inhibited.

The fourth and last condition necessary for growth is a suitable temperature. Investigations have shown that trees must have an optimum temperature lying between 75 and 90 degrees F. From this it is easily understood why cold summers or very hot summers are unfavorable for growth.

Any one of these conditions may vary greatly without appreciably affecting the other three and yet whenever any one factor remains for any length of time, at an unfavorable point, growth ceases. From this we can see that a tree is an extremely sensitive

organism which is even more responsive to conditions than animals and for this reason may be more susceptible to unfavorable conditions than the latter.

Formative stimuli.—We have thus far considered growth simply as such without especial regard to the ultimate result. We must now consider various agents which curiously enough are necessary for normal development yet are in themselves unfavorable to growth. The first of these agents is light.

You are all familiar with the rapidity with which the sprouts from potatoes develop in darkness. The most distasteful work of my boyhood consisted in sprouting potatoes in the home cellar and I often wondered why in creation potato stems grew so "blamed fast" in the cellar. That condition has now ceased to be a mystery to me but its disappearance has in no way decreased the haunting fear of going into my cellar and finding the potato sprouts have grown several inches since I last saw them. If there is much light in the potato bins the sprouts will be much shorter and will not develop so rapidly.

Light influences growth in various ways; it retards the elongation of rapidly growing organs and it affects profoundly the form of the tree. The relation between light and growth has been carefully studied and it has been found that growth during the brightest period of the day gradually decreases until about six o'clock at night when it is at its lowest point. From this hour it gradually increases until it reaches its maximum at about four o'clock in the morning when it begins to decrease again. In nature this phenomenon of the effect of light upon growth is closely associated with temperature which in turn is closely correlated with evaporation from the tree. The inter-relation of these agents and their effect upon growth is an intricate problem which need not be discussed here.

The effect of light upon the form of a tree is a very interesting and instructive problem. In general it may be stated that light retards elongation of organs and stimulates growth in breadth and thickness. An instance of this may be seen when a section of a leaf is made which has been exposed to light during much of its development. Here it is seen that those cells on the upper surface of the leaf are longer in their vertical axis than in their longitudinal axis.

On the other hand the tree seeks to obtain for itself as much light as it needs in order to carry on its vital activities. This is seen by noting how a large proportion of the leaves and branches of a tree point towards the direction of most efficient light. This phenomenon however is not directly one of growth but is one associated with the manufacture of food for the tree which has been previously mentioned. It is unquestionable that light exerts a large influence upon the form of a tree as well as upon its reproductive processes shown during blooming and setting of fruits.

Less important as agents in growth but of a similar effect upon

the plant are electric waves. It has been shown conclusively that the germination of seeds is hastened by electric stimuli and that the growth of the seedlings is also accelerated for some time by such treatment.

Chemical agents may be much more important in the growth of a tree than we have supposed. We are all familiar with the fact that trees need certain chemical elements for food but perhaps you are not so familiar with the negative effect of chemical compounds which may act as poisons to the plant and cause stunted growths in a similar way as does the lack of water. Stunting may also result and perhaps more often does result from the lack of sufficient chemical food with which the tree may manufacture new tissue and reserve food, than it does because of toxins.

Injuries are important as agents in growth. Tissues may, by various sorts of injury, be made to develop abnormally. Advantage is made of this fact rather constantly by fruit growers and is of great importance in grafting and budding trees.

Somewhat closely related to injury is the reciprocal influence seen between similar organs when accidents occur to one of them. For instance the removal of one or more branches from a tree may stimulate the development of new flower and leaf buds on some other branch, or at some other point on the tree. Every orchardist knows how to take advantage of this close relation by proper pruning to induce new growth where it is most desirable. By such methods the entire form of a tree may be changed.

We have now considered rather briefly the three phases of growth, the four important conditions of, or agents in growth and the more important stimuli acting upon the form of growth. Several points of more than passing interest have been touched upon, most of which have to do with the physiological activities of a growing tree. I have thought best to reserve the discussion of these points for the last part of this paper. They may perhaps best be brought out by a number of questions such as: How do trees take in water? What becomes of this water after it enters the tree? How much water does a tree take from the soil? How does the tree manufacture food within its tissues? I have enumerated what seem to be the most important and interesting from the practical standpoint and I will try to make these points clear in the brief time allowed.

You are all no doubt familiar with the fact that near the tips of growing roots there are many very fine root hairs. These root hairs are very important to the growth and life of the tree for they possess the power not only of absorbing water but also of selecting or rejecting certain materials necessary or undesirable for the tree as the case may be. It is a sufficient answer to the first question to say that these root hairs are the principal organs through which water is taken into the plant.

After this water enters the tissues of the roots by osmosis it is carried to the aerial parts of the tree. It travels upward within certain elongated cells in the sap wood which we call ducts or ves-

sels and which are continuous the entire length of the tree and branches and extend into the leaves. Within the leaves part of this water is used by the tree as an agent in the production of food. After this food is manufactured in the leaves it passes back through the inner bark-cells, down the branches and trunk to furnish food to the cambium and roots. We know this to be true because a girdled tree dies from root starvation if only the bark is cut away. It may be stated here that only a very small amount of the water taken in by the roots remains in the tree or is used in the manufacture of food. Probably 90 per cent. or more of it, which passes up through the vessels into the leaves is from them evaporated into the air.

The amount of water which a tree takes from the soil varies greatly according to temperature and the season of the year. It is much greater during the growing season and may be measured approximately by the amount of water evaporated from the leaves. This amount varies of course with the age and number of leaves on a tree. It has been carefully estimated that a beech tree fifteen years old evaporates about twenty gallons of water daily during the months of June to September inclusive. This is no inconsiderable amount and one hardly understands where the tree obtains such an amount of water, over such a long period. In a dry season this amount is without doubt considerably lessened, a fact which makes it important for orchardists to conserve as much of the soil moisture as possible by methods of soil mulching.

The process by which a tree manufactures food for itself is extremely complex and is not known with exactness. The hypothesis generally accepted is that the green coloring matter of the leaves absorbs sunlight and that the energy obtained in this manner is used by the living matter, which is called protoplasm, to unite the water brought up by the roots with the carbon dioxide taken into the leaves from the air. The result of this union, in whatever manner it takes place, is the formation of starch and later sugar which composes a large part of the food of plants. There are many other matters which might be properly discussed in connection with the manufacture of food by the plant. By-products, such as gases and acids are important and interesting but lead off into discussions not exactly pertinent to our subject.

If I have been successful in making clear to my audience some slight idea of how trees grow I shall feel that I have not only rendered a service to my listeners but also to the science of fruit-growing in particular, for much of success in your field of work depends upon a clear understanding of the life processes of your trees.

PEACH GROWING FOR MARKET.

S. H. Fulton, *Manager Sleepy Creek Orchards, Sleepy Creek, W. Va.*

Next to the apple, the peach is the most important orchard fruit produced in the United States. There are more than half as many bearing peach trees as apple trees in this country and the value of the peach crop averages about one-third that of the apple crop. While not so widely grown as the apple the peach is, nevertheless, cultivated over a great range of territory and is produced in all except the coldest portions of the United States. For nearly seven months of the year, peaches may be found upon any of the large city markets. In April small white peaches of the Peen-To and Honey types begin to arrive on the northern markets from Florida, followed shortly in order of ripening by Greensboro, Carman, Elberta and other varieties from Georgia and Texas. Before these latter states are through shipping, the crop from Arkansas, Missouri and the Carolinas begin to move. These sections are in turn followed by the Virginias, Maryland, Pennsylvania, Ohio, Michigan and New York State. Many other states aside from these mentioned also produce a good many peaches. Late varieties from the Allegheny Mountain sections and the Great Lakes region round out the season during the month of October.

Georgia ranks first among the states of the Union in number of bearing trees, having in 1910 over 10,000,000 trees. Next, in the order named, follow Texas, California, Arkansas, Missouri, Oklahoma, Kansas, Alabama, Tennessee, Ohio, Michigan, Illinois and Pennsylvania, making Pennsylvania the thirteenth state in number of bearing trees. In value of crops produced however, Pennsylnania takes higher rank. In 1909 which was a good average year, California ranked first, followed by Georgia, New York, Michigan, Arkansas and Pennsylvania in the order named, placing Pennsylvania sixth in the value of the peach crop.

In planting peaches for commercial purposes in any given section, the grower should aim to plant varieties which will ripen at a time when there will be the least competition from other sections. No peach ripening before the Georgia season is over should be planted to any extent commercially in this latitude. Late varieties may be expected to come into competition with fruit from Michigan and New York State. In the eastern pan-handle of West Virginia, we have found varieties ripening between the northern and southern crops most profitable. Such varieties ripen in August and include Carman, Champion, Belle of Georgia, Reves Favorite and a half or more of the Elberta crop. Among late varieties, we grow Fox, Stevens, Smock, Wonderful, Salway and Bilyeu. If the northern crop is not too heavy these late varieties pay us well.

Varieties of good size and good color are to be preferred. Small fruit is likely to be discriminated against by buyers especially in a full crop year.

Spraying is essential for scale, brown rot, scab, etc. Lime-sulfur is the best preparation known for San Jose Scale. Oils are dangerous, often killing the fruit buds and sometimes killing the new wood. For the Lecanium or Terrapin scale the writer has had good success with soluble oil, one to fifteen applied just before the trees bloom. For brown rot and scab self-boiled lime-sulfur or a proprietary remedy known as "Atomic-sulfur" give excellent results. Even at high altitudes where diseases of the fruit are not expected to be troublesome, it will pay to spray. Two applications are usually necessary. In the first, it is well to use about one and one-half pounds of arsenate of lead to fifty gallons of the spray mixture for the curculio.

In our early experience at Sleepy Creek, we lost a good many trees from borers. Later we learned that it was necessary to go over the trees twice in the spring of the year. The first time over, we remove the earth from the base of the trees and take out all the borers that can be found. The second time over, any borers which were overlooked the first time are removed and the earth shovelled back about the collar of the tree. If the earth is removed, trees wormed and dirt put back all at one operation enough borers will be overlooked to kill a good many trees on soils where the insects are very numerous. On badly infested areas, we usually worm young trees again in the fall of the year. The entomologists of the West Virginia Experiment Station are experimenting with a variety of remedies for the borer but thus far have reported no satisfactory line of treatment other than removing the worms with a knife or other pointed instrument.

Pruning should be done with a view to admitting plenty of light and air to the tops of the trees. Personally the writer likes low open centered trees with only three main branches. Careful systematic pruning will do much to keep the tops within manageable bounds and will prolong the profitable life of the trees. Trees injured by winter freezing or stunted through overbearing or lack of plant food can be thrown into vigorous growth by moderately severe pruning.

Peach trees are rank feeders and must be fertilized for profitable results particularly on thin land. On light soils plenty of nitrogen should be supplied for wood growth and bud formation. Potash may or may not be needed. Acid phosphate is usually essential. A test of different fertilizer ingredients alone and in combination is almost certain to prove valuable in any peach orchard. A test by the West Virginia experiment station in our Sleepy Creek orchards disclosed the fact that nitrogen was the limiting factor in the fertilizing formula we were using and potash was needed only in a very limited way if at all. We had been using large amounts of potash on the theory that potash increased the fruitfulness of the

trees, and aided in the development and coloring of the fruit. The test above referred to indicated that there is already sufficient potash in our soils as applying or withholding potash made no difference in the tree or crop. The peach grower should mix his own fertilizers. He can easily prepare a formula to suit the needs of his trees, he will know exactly what he is using and will save several dollars per ton.

Harvesting in this section from which a number of large city markets can be reached in about twelve hours by express or from twenty-four to forty-eight hours by refrigerator cars, need not be performed until the fruit is well colored and fully developed. No indication of softening, however, should be apparent at picking time. Half bushel round oak baskets with drop handles are very convenient for picking and hauling to the packing house. Low-down wagons with bolster springs and double deck beds, holding about fifty baskets, are very convenient for hauling from the orchard to the packing shed.

At the packing house the fruit should be graded into from two to three sizes for carriers. Second grade fruit, consisting of small size and misshapen specimens, pack to advantage in this section in round half bushel baskets commonly called "Delawares." All over ripe and unsound fruit should go into the cull baskets. Women usually make better graders than men and are to be preferred for this work.

For packing we use home help together with a number of expert packers from the South. We pay the home help two cents per carrier and the southern packers two dollars per day with board and railroad fare one way from the last point in the south at which they worked. We find the southern packers economical help to employ and believe it will pay peach and apple growers in this section to encourage the coming of these young men who follow packing the year around and become very expert.

Usually the peach grower finds the marketing problem the most serious one with which he has to contend. The great bulk of the peach crop of the country is shipped on consignment to commission houses in the large cities. A relatively small portion of the crop is sold to buyers, f. o. b. the shipping point while a very small quantity is sold direct to the retail or consumer. Shipping on consignment is fairly satisfactory if the grower is in touch with good reliable commission houses. However, fruit shipped in this way goes only into the regular channels of trade and at times when there is a glut in the market as occurred last fall when the New York state Elbertas were in season, prices were very low.

Selling f. o. b. or shipping direct to the consumer takes the fruit out of the regular channels of trade to a certain extent and often means better prices. Track sales in sections where orchards are isolated and buying is not a common practice do not, however, always work out well. Usually the buyer insists on receiving the fruit before settling for it. Meanwhile, in case the market lowers,

the grower is likely to have trouble in getting full settlement. Track sales of peaches should always be on the basis of settlement before the car rolls. Here is where an organization or association of growers comes into play as concerted effort on the part of the growers of a given section is necessary to bring about desired conditions in the way of compelling buyers to meet the requirements of the growers.

For the small grower or the large grower with plenty of help for performing extra work involved in shipping small orders in the way of bookkeeping, sending our bills, collecting, etc., dealing direct with the consumer may work quite satisfactorily for disposing of at least a considerable portion of the crop. Such sales usually mean larger profits for the grower. In past years the handling of small shipments by express has often been very discouraging to the grower on account of double charging and bad handling by the express companies. With parcel post rates increasing and charges lowering, this system of transporting is being watched with keen interest by fruit growers and it is to be hoped parcel post will shortly aid materially in the problem of distributing the fruit crop of this country.

Mr. J. H. Arnold, Agriculturist of the Office of Farm Management, United States Department of Agriculture, has made a careful study of the peach growing industry in eastern West Virginia and has published some interesting facts and figures in Bulletin No. 29. Mr. Arnold found the average cost of producing peaches in this section over a ten-year period to be about sixty-three cents per basket. The average price received, for the same period was between sixty-seven and seventy-four cents per basket. The average net profit, therefore, was between four and eleven cents per basket. While these figures are not strictly accurate as they are obtained by compiling data furnished by a considerable number of growers who as a rule do not keep accurate account of all orchard transactions, nevertheless, they are doubtless approximately correct and serve to show that for the average peach grower no wide margin exists between profit and loss. In every peach growing section there are plenty of examples of unprofitable peach orchards. Among commercial peach growers, only men can be expected to succeed who give careful, persistent attention to the many problems surrounding the selecting of varieties, planting of trees, cultivating, spraying, pruning fertilizing, worming, removing diseased trees, harvesting and packing with an unusual share of attention and energy when it comes to marketing.

THE NEWER DISEASES OF FRUIT TREES AND LATEST DEVELOPMENT IN THEIR TREATMENT.

PROF. C. R. ORTON, *Plant Pathologist, Department of Botany, Pennsylvania State College.*

In the application of the subject of fruit diseases we have a variety of conditions to contend with, not only as to the methods and treatment of our experimental work, but also in furthering the practical side such as the fruit grower has to deal with. We have on the apple in this state about twenty diseases, all but one or two of which are of a fungous nature. Most of these are more or less of serious importance, and perhaps there are about five or six of them which you might call of newer origin.

Now just what do we mean by newer diseases? Ordinarily we mean the diseases which have been introduced into the state more recently. That does not mean necessarily that these diseases have suddenly come into existence. It simply means that they have probably existed somewhere else indefinitely and have been introduced here recently from other localities; or at least if they have not been recently introduced, they have only recently been brought to our attention. As an instance of this I will cite the chestnut blight fungus which you have all heard so much about. That has been supposed by some to be a disease which was present in this country for a good many years, but which only recently attained very much importance. That is, some pathologists thought it had been present upon the chestnut trees for years, but owing to certain conditions in the cultivation of the chestnut the trees were weakened in such a way that they became subject to the attack of this fungus.

More recently, however, it has been proven conclusively that the chestnut blight fungus was imported from China. It was probably brought over here on imported chestnut trees from China which were planted in the vicinity of New York City, and as soon as the disease came into contact with the American chestnut, which is very susceptible, it attacked it and caused great devastation.

I am going to take up first some of the newer diseases and treat them a little more fully, and if I have time will take up some of the more familiar ones. We have among the newer fungous diseases bitter rot, (Glomerella rufomaculans) although possibly it should not be called a new disease in Pennsylvania. It is perhaps better known than blotch, fruit spot, and Illinois apple canker. Among the bacterial diseases not so well known we have collar blight and crown gall and in the physiological diseases we have fruit pit and water core.

We will take up first bitter rot. It is primarily a disease of southern and middle western orchards, and it has become probably the most serious apple disease in certain of those fruit growing regions. Now it is becoming a very serious menace in the Penn-

sylvania orchards. On the fruit it is characterized by producing a brown decay in the center of which appears a pinkish mass of spores. These spores usually appear in circles, originating from a small infection spot. Fig. 1. On the branches and twigs it forms a canker. There are a variety of cankers on apple trees. Bitter rot forms a canker somewhat similar to fire blight on limbs and trunks. In fact, it is pretty difficult to tell it unless you find the fungus on it. There is usually one difference however; in the bitter rot cankers there is usually more cracking of the bark than you would find in a fire blight canker. It usually cracks down into the sap wood. So then, you have these two effects of bitter rot, one on the fruit and one on the limbs.

Fig. 1. Bitter Rot *(Glomorella rufomacularis)*, Showing the Spore Masses Arranged in Concentric Circles.

Now in the control of this disease there are two things to take into consideration. There is a summer spore stage and a winter spore stage. On the fruit only the summer spore stage is produced. These spores spread the disease rapidly from one fruit to another during certain weather conditions. This usually takes place in July or August when warm, humid conditions prevail. On the branch the fungus brings about the production of the winter spore stage which is able to live through the winter in the cankers and is resistant to the cold. The spores from this stage germinate in the summer and re-infect the fruit that season.

In the control of this there are two things to do; first, to spray the tree to prevent infection of the fruit in the summer, and second, to cut out the cankers in order to eliminate the source of infection. The most important by far, I believe, is the removal of these cankers for they are the source of contamination year after year from the same place. Unless you remove these you are constantly increasing the liability of infection of your fruit.

In cutting out it is very essential that you take sanitary precautions in the same way as in fire blight, although perhaps not quite so strictly. Make your cuts smoothly and sterilize your instruments. Also sterilize the wound and paint it with a good paint. Asphaltum is one of the best dressings for cuts and wounds we have now. White lead and oil may also be used and is easily prepared and

applied, but is liable to crack. Use the best grades of asphaltum, preferably having a high melting point, at least 250 degrees F. This is in order that during the hot weather in the summer it will not run. It also has the advantage that it does not crack as the others often do.

C. J. Tyson.—How can we secure asphaltum of that kind?

Prof. Orton.—There are several companies which put out asphaltum of these different grades and they will submit prices to you on application. The Standard Oil Company puts out asphaltum of that grade called Korite. It costs twenty ($20.00) dollars a ton F. O. B. The Barber Asphalt Paving Company, Maurer, N. J., puts out a grade ready for application, at 35 cents per gallon, F. O. B. Of course the higher the grade the higher the price.

Question.—What is the paint like?

Prof. Orton.—It is usually in a hard mass and looks a little like a lump of coal It will only melt when it is heated to this high temperature.

Question.—Then, how is it applied?

Prof. Orton.—It may be applied with a brush while warm, or it may be diluted with linseed oil and naphtha and applied cold, which in many ways is preferable.

We come now to the second disease, *blotch* (*Phyllosticta solitaria*). Blotch is another disease essentially of southern orchards. It first attained serious importance as an apple tree disease in Missouri and adjacent states. It attacks both the fruit and twigs as does the bitter rot but with quite different symptoms. It may be interesting to know a little of the history of the fungus causing this disease. It was first described from Bethlehem, Pennsylvania by L. von Schweinitz, a mycologist. He described this disease of apple trees about the year 1830, but it never came into importance as a disease producer until about ten years ago in the central west, when investigations were undertaken by the Department of Agriculture to control it. On the fruit in the early stages it produces a spot somewhat similar to the sooty blotch which is so common on ripe fruit. A little later in these spots begins the formation of a sunken area in the skin, which turns a tan color, and is very leathery in appearance and texture. In these leathery areas minute black spots appear, in which the spores are produced. On the twigs it produces first a small pustule or canker, which is about 1/8 to 1/4 inch in size, usually nearly circular and highly colored, perhaps reddish, or tan colored, but nearly always somewhat higher colored than the healthy bark around it. A little later the bark around this spot cracks and there is a canker formed. The spot then becomes slightly sunken. These cankers are usually on the younger twigs. In connection with the fungus we have never yet found a winter stage, so that so far as we now know, control by spraying is the only practical method to follow.

Now in spraying for this a similar method of application as is used for bitter rot is satisfactory for the *blotch*. Three or four

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applications, beginning about three weeks after the petals fall ought to control it. Two applications in Missouri usually controls it. Three is safer, however. As in the case of bitter rot, warm sultry weather is more favorable for its development than dry cool weather. For the control of *blotch* in Missouri, Bordeaux is preferred to lime-sulphur. It will require experimental studies to determine which is better for Pennsylvania conditions.

Then we come to *fruit spot,* or what is known locally as the Baldwin fruit spot. It also attacks various other varieties, as the Twenty Ounce and York Stripe. It probably occurs on the York Imperial and Gano, but is primarily what we know as Baldwin Fruit Spot, and should not be confused with bitter pit which is another name for fruit pit, on Baldwin, Gano and a large number of other varieties. It is a superficial spot and is somewhat similar to the spot on the Jonathan, although usually a little larger than that. It is due to a fungus called *Phoma Pomi,* which was first described from New Hampshire by Prof. Charles Brooks. This disease was serious in New Hampshire four or five years ago and has been reported several times in Pennsylvania. It has not, however, attained very serious importance, and is readily controlled by ordinary spray applications. Two applications are sufficient. It appears a little later than scab and ordinarily the third and fourth applications for scab will control it. It does not affect the branches or twigs so far as is known.

Member.—What would you spray with?

Prof. Orton.—Spray with lime-sulphur or Bordeaux.

We also have in Pennsylvania the blister canker, (*Nummularia discreta*), which at least some of you have heard of. It was first called Illinois Apple Canker because it was described from Illinois and was found to be doing a considerable amount of damage in the older orchards there. It attacks only the wood where it causes a large number of small blisters. It usually attacks only old trees, over twenty-five years of age, and on the larger limbs, although it will extend out on the smaller limbs.

It is not usually serious in well cultivated and well taken care of orchards and is somewhat like black rot in that respect. In Ohio where it has been studied recently, it has been found to be the cause of a great amount of injury in the southern orchards that have been neglected somewhat. It may often follow Fire blight or other injuries. I found it in the old orchard at State College where several trees have been practically ruined. It has also been reported from several other parts of the state.

In the control of this there is only one method of procedure and that is to cut out the cankers. Cut back well below the point of injury. There is another point which should be mentioned in connection with the detection of these blisters. You can always tell them easily if you will run your knife through the bark and peel off a strip. In each one of these blisters there is formed a little black ring. These rings are where the spores are borne.

There is one more fungous disease which I want to take up—*Volutella rot*. I know of no other name for it. If you can become familiar with that perhaps it is the best name we can use. It was first described from North Carolina by Dr. Stevens. In appearance it is very difficult to distinguish from black rot. It escaped my attention several times, until I finally examined the spores, then the difference was easily seen. Instead of producing a rot which progresses in a more or less circular area like black rot, the decay is more or less irregular in outline and even darker in color than is black rot in the early stages. Ordinarily, spraying as you would for black rot has been sufficient to control it.

We come now to the disease which is locally known in this state as collar rot. Right here I want to say that from investigations which have been carried out at State College, as well as investigations in the department of agriculture by Waite, and in West Virginia by Waite and Giddings, we have decided that *collar blight* is the name which should be applied to it. This has been said to be the most serious disease of apple trees in Pennsylvania. Last fall I made as complete a survey of the state as possible and with the information at hand I find that it is prevalent in twenty-two different counties of the state. These twenty-two counties represent our chief apple growing sections. In some counties, especially Adams, Allegheny, and Franklin, it is very severe. I think probably in these counties it is more severe than in any other part of the state.

There is some interesting history in connection with this. It was first brought to the attention of Dr. J. P. Stewart here in Pennsylvania in 1907, and I think it was in Franklin County that Stewart first had his attention called to it. He wrote to M. B. Waite at Washington, who came up and examined the orchards. Waite carried on a preliminary investigation and decided it was probably due to the same organism that causes fire blight, viz: a bacterial disease attacking the tree at the crown. Stewart published an article in the *Rural New Yorker*, calling attention to this disease.

An investigation of *Collar Blight* was started in 1910 at Pennsylvania State College in co-operation with Mr. D. M. Wertz, at Quincy in Franklin County. It was very serious in his home orchard, and experiments have been carried on in his orchard since that time.

The characteristics of the disease are something like this,—many of you are probably familiar with them. There is at the collar of the tree a progressive dying of the bark. It is often underground, sometimes extending slightly above the ground in the early stages, but not usually. Perhaps it will remain unnoticed until the second year when the tree dies. In the early part of the second year if you are at all careful in noting the condition of your trees, you can usually see on one side of a tree that is affected, a sparseness of foliage which appears off color and slightly yellowish. Fig. 2. A similar condition of foliage may be noted in the late summer or

Fig. 2. Tree Diseased with Collar Blight. Note Sparseness of Fruit and Foliage.

fall of the first year in severe cases. If the tree bears fruit it ripens somewhat prematurely and is of small size. Those are the symptoms by which we diagnose the trees in most cases.

If you find a tree in that condition, examine the bark to see if it is softened and decayed around the roots and crown. If it is you are almost sure to have *collar blight* there. Its progress during the first summer may be considerable, perhaps it will work half way around the tree, and perhaps extend two or three inches above the

Fig. 3. Collar Blight which Has Progressed Three or Four Inches Up the Trunk Above the Ground. Note Suckers at Right Side of Trunk.

ground the first summer, or it may remain entirely unnoticed and below the ground the first summer.

In the late summer it goes into a dormant stage and remains so through the winter. When the growth starts in the spring you may have the beginning of the final stage which constitutes a rapid girdling of the tree at the collar, or the blight may start right up the

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trunk of the tree and extend into the branches and kill it in two or three weeks. Later on the outer bark of the tree may be seen hanging in strips, like ribbons. This is a characteristic of fire blight in late stages after the tree is killed. The trees may not always be killed the second year after being diseased. They may last for several years depending upon various conditions about which we know but little as yet.

From our investigations we have decided that there is no doubt but what this disease is caused by the fire blight organism. In the Wertz orchard a number of experiments were carried out. The infected bark was removed from diseased trees and a portion taken and inserted under the bark of a healthy tree. In that way we thought we might be able to judge whether the disease could be transferred from one tree to another. In almost every instance we found that the disease was transferred to the healthy tree. From further experiments and pure culture inoculations we have come to the conclusion that without doubt the bacteria of fire blight are one of the primary causes of collar blight. There are various other organisms associated with it, but whether they are active in spreading the disease is a question which has not been worked out yet.

A fungus which is claimed to cause *root rot* in Missouri and Ohio, appears with us in the form of what are called toad stools around the base of the tree, but whether this fungus is actually spreading the disease we do not know yet. We do know that it is occasionally found along with this and may be more important than we have supposed.

R. M. Eldon.—Does it show these toad stool growths? Would it need to be confined to an apple tree?

Prof. Orton.—Almost any kind of a tree may be atacked by it. Yes, it will usually show the toad stools, especially in the late stages.

How do trees become affected at the crown? Is there any relation between a tree that is subject to fire blight in the top and one which is likely to be attacked by collar blight? These are some of the problems that we have come up against.

We find that there is little correlation between the susceptibilty of a tree to twig blight and that tree to collar blight. A tree that is subject to twig blight may not be subject to collar blight, but a tree which has no twig blight may have collar blight. The most plausible explanation seems to be that we have a carrier or agent which carries this organism around from an infected tree to a healthy one and there causes infection. In order to do this, whatever agent it is must visit at times the twigs on trees having fire blight, get the organism from those blighted twigs or limbs and carry it to the crown of some other tree. What agent is there which could do this thing? This is the problem that we are working on now. We have found several insects associated with collar blight. It seems most likely to suppose that some insect must carry this, and the most plausible theory seems to be that bark borers and possibly wooly aphis are instrumental in spreading it. In practically every case of collar blight we have found borers directly associated with it. In at least 75 per cent. of the cases, wooly aphis are present, but whether they are there as a secondary organism or not is a question we have not worked out.

C. J. Tyson.—Do you think there is a possibility of borers being the effect rather than the cause?

Prof. Orton.—That is what I suspect is the case with the wooly aphis. It might be the case with the borer but we are not sure yet. It is a point which has not been worked out and is one of the most important points yet to be settled—the relation of the agents to the spread of this disease.

A. W. Griest.—After the disease starts, did you ever know of its being cured?

Prof. Orton.—Yes, I will come to that now. I may as well speak of it right here. In the treatment of the disease we have followed the cutting out method, which seems to be the only practical one. There is just about an even chance of saving the tree. If you find the diseased trees the first year, preferably during the first two or three months of infection, you can save them by promptly and properly cutting out the infected area. If the disease is not detected until late in the second year the chances of saving them are rather small. Now extreme care and considerable technique is required to successfully cut out this disease. You have to cut out all of the infected portions and be extremely careful to sterilize your instruments or infection will be carried to the new wood into which you are cutting. We have saved several trees that have been one-third girdled and we have saved one or two that have been half girdled. We have not kept items on the cost of cutting but do not think that the cost would run over $1.00 per tree.

Question.—What season of the year is best for it?

Prof. Orton.—It is preferred to cut it out during the fall or spring after the first year's infection, but if you can find it sooner, I would not hesitate to cut it out in the summer time during the growing season, if sufficient care is taken in sterilizing the instruments. There is less danger of spreading the disease during the dormant season than during the growing season for the bacteria are not so active at that time.

C. J. Tyson.—Is it easier to note the symptoms of the disease in the summer time?

Prof. Orton.—It is very much easier. It is difficult to detect them in the winter. Mark your trees during the summer and do the cutting out later on. A mallet and chisel are the instruments to use, a sharp gouge chisel with about 1½ inch blade. The bark and sap wood should be cut back at least two inches from the margin of the diseased area. You can tell by the color of the cambium whether there is any infection there. If you see any browning under the bark, cut back until you get away from that brown color. Corrosive sublimate is the best agent for sterilizing your chisel or other tools used for cutting.

C. J. Tyson.—How about formaldehyde?

Prof. Orton.—Formaldehyde solution I would not recommend. It probably would be efficient but there is a possibility of its being more injurious to the tissue of the tree and is not pleasant to use.

Question.—What strength of corrosive sublimate?

Prof. Orton.—One to one thousand. That is made up by using at the rate of one tablet to a pint of water. It should be labeled *poison* and placed out of reach of children.

After cutting back of the diseased area and taking out the diseased roots, sponge over these wounds with corrosive sublimate of this strength. Allow this to dry and then paint over with asphaltum or pure white lead and oil.

R. S. Taylor.—Would not the extreme heat of the asphaltum hurt the bark?

Prof. Orton.—No, it might injure the bark just a trifle but not enough to prevent the cambium from healing. Again let me urge the necessity of getting asphaltum of a high melting point.

R. M. Eldon.—Can you handle that in the winter time?

Prof. Orton.—We have handled it in the spring. The especially prepared asphaltum which has the proper constituents and density is much easier handled though.

Question.—Would not lead and oil paint answer?

Prof. Orton.—That will answer but the trouble is, it is not so elastic and does not adhere so closely. The point is to keep the area covered with something that will not crack or peel off and will keep out the water.

Question.—Do you bank up trees?

Prof. Orton.—No, after we paint them we put the soil back in place, but we do not bank up the trees. Right here I want to bring out a point in connection with this. Dr. Stewart, in his work, has found that mulching or banking is likely to render the trees more susceptible to diseases, especially fire blight, than those not so treated. There is another interesting point here as to whether or not this banking may not have some effect on the work of borers by producing conditions that are especially favorable for their work. We would not therefore recommend banking the tree, but only replace the soil on the level.

R. M. Eldon.—Could anything be done to aid a tree that is dying from root rot? I have a maple tree, that has been going back for a year or two. Have noticed toad stools growing around the base of the tree.

Prof. Orton.—The only remedy in case it has not gone too far and too many of the roots are affected, would be to dig away the soil, especially on that side of the tree where you see the toad stools, and cut away as many of the diseased roots as possible from the trunk of the tree, and pull them out of the soil. The wounds made, during this process of removal of diseased roots, should be painted over carefully.

If you can remove those roots and pull them out you have a possibility of saving your tree, at least for a time.

Question.—How soon would it be safe to plant another tree in the same place when one of these trees have died of Collar Blight?

Prof. Orton.—I think the point there is one of removing all of the infected tissue of the old tree. Pull out the old tree and remove as many of the diseased roots as possible and I think there is not a great deal of danger. The organism cannot live in the soil; it must have live wood to live on, and if all the tissues of the tree are dead the organism is dead. If some of the roots are alive you may have danger of infection on the tree you plant there, provided the old roots come in contact with the roots of the newly planted tree. That danger however seems negligible.

C. J. Tyson.—It would be entirely safe then to remove the tree and wait a year.

Prof. Orton.—I think perhaps it might be more practical to wait a year, although Mr. Wertz has been putting trees right in soon after removing them. Although he has not noticed any trouble from that practice, he might later on. Here again is another condition to consider. We noticed that the trees affected with collar blight are usually between the ages of seven and twenty years. Seldom is a tree affected under seven years old, and very rarely over twenty years. It affects the tree at the most vital stage of its life and when the tree is most valuable to its owner. We also find that trees under a good state of cultivation are usually more susceptible to it than trees that have not been forced so much.

Another important point is root grafts; in 90 to 95 per cent. of the affected trees we find that they were root grafted. This seems to be a very significant point. Whether or not root grafts render the trees susceptible to this form of blight at the crown is most important. I believe trees that are root grafted are likely to be more susceptible than those that are budded.

There is another factor that might have some bearing upon the difference in the susceptibility of a tree to collar blight and a tree to fire blight. In the case of root grafts, a scion of one kind is grafted into a stock of another kind. You might have scions which would be susceptible to twig blight and stocks which would be resistant to twig blight, or vice versa, in which case the stocks might be more susceptible to collar blight and the scions resistant to fire blight.

Still another point are soil cups. We have in some cases indications of soil cups as predisposing factors. In one case the party has low lands where the water stands in the spring until rather late. His trees practically all died in that part of the orchard. He thinks he lost them by collar blight. It may have been winter injury, but at least it is worth knowing that soil cups produce very unfavorable conditions for trees to grow in.

Now regarding the resistance of varieties. From our work we have not found any variety in the state, so far as I know, that is resistant to collar blight under all conditions. I think any variety is likely to be attacked by this disease and that whatever immunity

some varieties may appear to possess may be due more to favorable conditions than to any inherent resistance on the part of the variety. Some varieties appear more susceptible than others but I think part of this apparent susceptibility may be due to unfavorable conditions, at least in part.

We now come to the so-called physiological diseases. I want to speak of them in connection with what we call fruit pit. Here also perhaps, belongs what we term the Jonathan fruit spot. Fig. 4. By physiological diseases we mean those diseases caused by some disturbance of the physiological activity of the plant, not due to bacteria or fungi, but to some unfavorable environment or condition of the tree often brought about by such factors as unfavorable soil or atmospheric conditions, etc.

In this state, Gano, Baldwin, York Imperial, Northern Spy, York Stripe, and others are affected by fruit pit. There are a variety of names for it. Many plant pathologists prefer to call it *bitter pit;* the Germans call it "stippen." A great deal of investigation has been carried on in connection with it in various countries. Some European investigators believe that it is caused by an improper balance between transpiration of water and the conduction of food to the fruit. Probably complete fertilizers may cause it to become more serious. You will notice little brown spots all through the apple, later on the surface becomes pitted. Fig. 5. On the Jonathan we have a similar condition except that these spots usually show first on the surface, showing how the cells near the surface usually are the first to break down. *Fruit pit* is probably the second, if not the first, disease of importance in this state. We know of no remedy for it. The Department of Agriculture is carrying out some extensive experiments with this disease and we hope that they may find something that will help out in the control of it in the near future.

R. M. Eldon.—Can we do anything about *water core?*

Prof. Orton.—*Water core* is another disease in the same category as fruit pit. So far as we know there is no remedy except careful cultural operations and good storage. It is caused by a variety of conditions, some of which are probably the same as those causing fruit pit.

R. M. Eldon.—I know in one variety that is grown here that those apples which are gathered latest, and allowed to become frosted have been affected.

Prof. Orton.—I think frosting is likely to produce a watery condition, possibly in this way; that freezing occurring at the ripening period is likely to change the starch of the fruit into sugar and it condenses about the core in solution.

R. M. Eldon.—Some apples are mouldy at the core, although they seem to be perfectly sound.

Prof. Orton.—That might be a later development of water core. It is caused by an organism that works in through the calyx end and produces the disease.

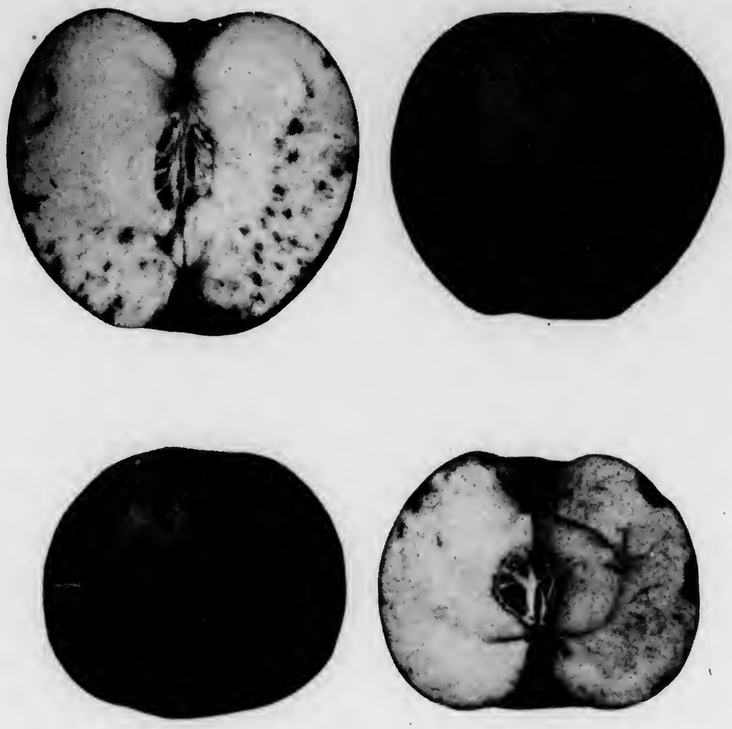

Fig. 4. Jonathan Above and Baldwin Below Showing Fruit Pit. Note How Much More Superficial the Pitting is on the Baldwin.

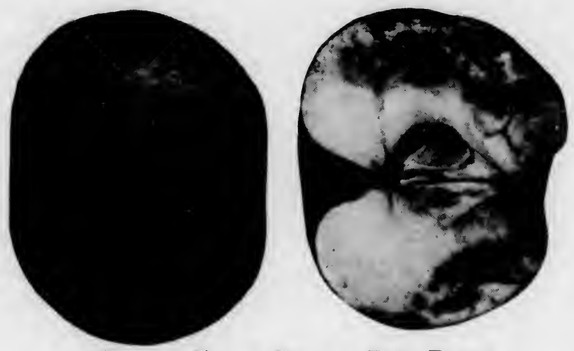

Fig. 5. Fruit Pit on Ben Davis.
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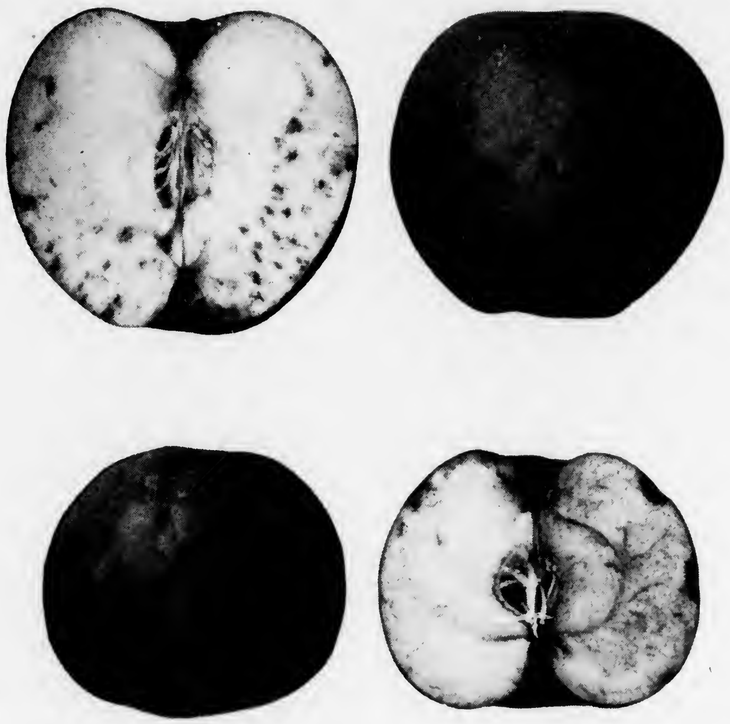

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POSSIBILITIES OF BEEF PRODUCTION IN PENNSYLVANIA.

PROF. W. H. TOMHAVE, *Department of Animal Husbandry, Pennsylvania State College.*

The subject of beef production in the eastern part of the United States is receiving considerable attention at the present time from both beef producers and consumers. The recent high prices received for beef cattle has created a new interest in this phase of the live stock industry to an extent where the farmers in Pennsylvania are beginning to consider what possibilities there might be in beef production in this state. It might be well to briefly review the reason for our present shortage of beef cattle all over the United States. This can best be illustrated by reviewing the more recent statistics concerning the population of the United States and also the supply of beef cattle on hand at this time. The population of the United States has been increasing at a rate of about 2,000,000 per year during the past decade. The number of beef cattle kept during this time have not increased in proportion to the population. Since 1909 the increase in population for the United States is approximately 12,000,000. During this same period the supply of beef cattle on the farms and ranges has decreased from 51,566,000 to 36,030,000 or more than 30 per cent. This readily explains why the price of beef cattle has gone up so rapidly since 1909. We find further that very rapid changes have taken place during the past few years in the exportation of beef from this to other countries. The exports from this country during the past year totalled less than 35,000 carcasses as compared to the yearly average of 250,000 for the decade of 1899 to 1909. The United States has virtually changed from an exporting nation to an importing nation, in so far as our supply of fresh beef is concerned. In reviewing the prices of beef cattle on the principal markets in the United States since 1885, statistics by five-year periods, show that the average for all beef cattle on the Chicago market from 1886 to 1890 was $4.06 per hundred; from 1890 to 1895, $4.13; from 1895 to 1900, $4.56; from 1900 to 1905, $5.13; from 1905 to 1910, $5.80; and from 1910 to 1913, $7.80. From these figures it can be readily seen that it is only within recent years that the price received for beef cattle has been in keeping with the cost of production, or in other words, the returns from beef production have not been such as to warrant making it a part of the farm business where a large amount of extremely cheap feed or grazing lands were not available.

During the last decade the beef producing center of the United States has constantly shifted. In the early history of beef production, Pennsylvania was generally considered the center of production. As immigration moved westward the beef industry kept pace with this movement. The lands in the state of Pennsylvania, or

at least in many sections, were considered too valuable for the production of beef and the farmers found it impossible to compete with the cheap grazing sections of the central and far west. These conditions resulted in the beef producing areas moving ahead of the plow. Pennsylvania and other eastern states were more intensively cultivated and consequently were devoted to the production of farm crops and dairying. However, the cheap grazing lands of the central and far west are now being used for farming purposes. The large western and central western ranges are cut up into farms which naturally increases the cost of production of beef cattle under range conditions. These economic conditions, together with our rapid increase in population, has resulted in a greater demand for beef in the United States and a decrease in the amount produced. The problem with which we are now confronted is how to meet and overcome the present shortage. It is apparent that it cannot be overcome by any one particular method, but that a combination of methods must be adopted in order to bring some relief. Some of these may be enumerated as follows:

First.—Making use of a large acreage of waste lands throughout the eastern and southern part of the United States.

Second.—The production of beef cattle on small farms.

Third.—Better breeding of beef cattle.

Fourth.—Cheaper and better methods of cattle feeding.

The state of Pennsylvania has approximately 15,000,000 acres of land that is untillable. Of this amount probably one-half is mountainous and can only be used for reforestation; the other half however, is land that can be used for grazing purposes and is capable of carrying a great many more cattle than it is doing at present. Pennsylvania has an abundance of rough and hilly land that is much better adapted to the growing of grass than for the production of farm crops. Much of this land is natural blue grass country which is excelled by no other grasses for the growing of live stock. It would be much better if many of the hillsides that are now cultivated were put into a permanent pasture so that live stock might graze there. To cultivate such areas is an expensive operation, besides when cultivated they are subject to washing and severe erosions.

Another natural advantage of Pennsylvania and the East is its abundance of water in nearly all sections together with a high annual rainfall. Plenty of good water is indispensable when it comes to the growing of live stock. The annual rainfall in Pennsylvania and other eastern states ranges from 35 to 40 inches per year, which is about 10 inches more than that of the central west and 20 inches more than that of the semi-arid regions or the western part of the United States. This greater rainfall not only means a constant supply of water for our cattle, but it also means a greater growth of grass and forage crops.

Proximity to good markets is desirable in the production of a commodity of any kind; this is as true of beef cattle as any other

farm produce. In this respect Pennsylvania and the east is at a decided advantage as compared to the central and far western parts of the country. The population of the area east of the Ohio line, including West Virginia and part of Virginia, is approximately 28,500,000 or more than one-fourth the population of the United States. This means that the large and desirable markets are in the producing centers of the east. The eastern farmer has an advantage over the central western farmers, in that it is not necessary to transport his commodities such a long distance, thus greatly reducing the freight rate. Another advantage is the combination of hill and valley lands which makes it possible to grow forage and grain crops in these valleys to feed the cattle during the winter. The hillsides may then be put into pasture, thus materially reducing the cost of operating the whole farm. This means that the farmer can give more attention to the growing of crops on the level or valley lands and grow larger yields per acre than where the whole farm is under cultivation. Besides, these combination farms, there are very large areas of cutover or waste lands that are producing a fair crop of grass at the present time. This goes to waste from year to year and is not utilized for any purpose. This land is capable of being used for grazing purposes and thus maintain a good many head of cattle each year.

Any farmer who intends to go into the beef producing business, especially from the breeders' point of view, should make it a point to start with a herd which has a foundation of beef breeding. The females of such a herd may be grades or pure breds depending upon the individuals that can be secured and the price that must be paid. As a commercial herd, good grade cows will probably be as desirable as pure breds because they do not represent as large an investment and yet will probably produce as good or better offspring than poor, pure breds. The one point, however, to keep in mind is that nothing but good beef sires be continually kept in the herd. Grade sires should never be used, as with such animals it is practically impossible to build up a herd of any importance. On small farms, where it is expensive for one farmer to purchase a pure bred sire for the use of his herd alone, it is a good plan to follow out a system of co-operation. That is, to have two or three farmers go together and buy a pure bred sire to be used on the different herds. This method of building up herds is being followed in some sections of the United States and gives very good results. It means that all cows may be bred to good pure bred sires at a comparatively low cost.

In the past it has been difficult to maintain a beef breeding herd without incurring a loss. This same difficulty is apt to be encountered at the present time unless the question of feeding is given due consideration. The aim should be to maintain the cows on a comparatively cheap feed. In this respect the east has a very marked advantage in that an extremely large amount of roughage is produced. The feeding of roughage to beef cattle is found advisable. Where the beef breeding cows can be fed a large amount of roughage during the winter and maintained on pasture during the summer months the cost of maintenance is materially reduced. The cost of maintaining a cow should not be more than the value of the calf which she produces. The calf at weaning time should sell for enough to pay for what feed the mother consumed during the year. Unless this is possible, it would be practically impossible to maintain a herd of beef-breeding cows without incurring a loss. We find that there is very little reliable data on this subject at the present time. With this thought in view the Pennsylvania Experiment Station started an experiment in the fall of 1911 to determine the cost of maintaining a beef-breeding herd. The following table will give some idea of the results that are being obtained. The figures here presented only cover the work of the first eighteen months. The results obtained since that time are in keeping with the figures which are here presented.

Maintaining Beef Breeding Cows.

December 1st, 1911—April 3d, 1913.

	First Winter	First Summer	Second Winter
Length of Period,	140 Days	210 Days	161 Days
Initial Wt. per Cow,	1,071.93 Lbs.	1,184.5 Lbs.	1,211.3 Lbs.
Final Wt. per Cow,	1,236.48 Lbs.	1,263.3 Lbs.	1,235.1 Lbs.
Total Gains per Cow,	164.55 Lbs.	78.8 Lbs.	23.8 Lbs.
Av. Daily Feed per Cow,		Pasture	
Corn Silage,	57.64		59.66
Cottonseed Meal,	1.00		1.00
Cost of Feed per Cow,	$16.13	$5.60	$19.31
Cost of Bedding,	3.94		4.52
Cost of Labor,	2.00	.76	2.50
Interest on Money Invested,	1.60	2.40	1.82
Value of Manure Produced,	6.63		7.60
Net Cost of Cow,	16.94	8.76	20.55

In reviewing this table it will be noted that practically everything excepting the cost of shelter is taken into consideration. Good market prices have been charged for all feeds consumed, not only resulting in more money than could be obtained if they were all to be sold, but that most of the fertility is kept on the farm instead of being sold from the farm. It will be noted that these cattle are kept on pasture six and seven months of the year and fed on corn silage as a sole roughage and one pound of cottonseed meal per head daily the balance of the year. The calves produced from these cows are kept on the same kind of a ration except that they are fed three pounds of cottonseed meal per 1,000 pounds live weight instead of one pound per head daily. The reason for this is that young stock require a great deal of nitrogenous material for building up of bone, muscle, and connective tissue. The results thus far obtained indicate that beef breeding cows can be cheaply maintained when they are kept in open sheds and fed almost entirely on an inexpensive farm product made up largely of roughage of one form or another. There are a number of regions in Pennsylvania where the pasturing period is considerably

longer than at State College and where such is the case it means that the cost of maintenance can be somewhat reduced, yet from the figures presented we feel confident that a beef breeding cow can be maintained the entire year for from $25.00 to $30.00. An important item to keep in mind is that all individuals in the herd are regular breeders. Irregular or shy breeders should be disposed of as soon as possible as the presence of such individuals in the herd will materially increase the cost of maintaining the balance.

Steer Feeding.

The feeding of steers have never been extensively conducted on the farms in Pennsylvania, with the exception of a few local regions. This, no doubt, has in part been due to the system of farming that has been followed and also to the comparatively low price that has been received for fattening cattle up to the past few years. We are convinced however, that it can be profitably done in almost any section of Pennsylvania, providing several important factors are kept in mind. These factors may be enumerated as follows:

First.—The making use of a large amount of roughage or cheap feeds such as clover hay, corn silage and corn stover.

Second.---Reduce to a minimum the amount of labor expended.

Third.—Avoid expensive shelter.

As an indication of what may be accomplished in steer feeding, I might give the results obtained during the past five years at the Pennsylvania Experiment Station. During this period, 178 head of steers have been fed in an experimental way. These cattle were all purchased on the open market and again sold on the open market at the close of the experiment. By purchasing and selling than under these conditions they were handled under identically the same conditions as afforded by the average farmer or feeder in Pennsylvania. Economy of production was one of the principal aims in all these feeding tests. The profits from feeding these 178 cattle after paying market prices for feeds consumed, range from a loss of $2.00 per head to a profit of $14.00 per head. The average profit during the five-year period was just $5.00 per head after paying for farm feeds. These cattle returned 98 cents per bushel of corn fed during the past five years. This certainly is considerably more than the price received for corn sold from the farms in the state of Pennsylvania during the same period and besides, this price received for corn, the fertility was kept up on the farm. As a further illustration of what may be accomplished by feeding steers, we have Lancaster County. The farmers in Lancaster County have been persistent cattle feeders during the past twenty-five years. They have fed annually from 40,000 to 60,000 head and are this year feeding in the neighborhood of 75,000 cattle. It is true that many of these farmers have fed cattle at an apparent financial loss year after year. They could have made more actual cash if they had sold their grain crops and hay instead of marketing it through beef cattle, yet, on the other hand, their system of farming, namely that of corn, grain, clover and tobacco, meant that they must keep the fertility of the soil up to a high standard so as to produce profitable yields of these crops. The result of this system of farming is that the fertility of Lancaster County land has been increased from year to year. They have been able to produce excellent crops the result of which was the increased value of their farm lands and has enabled them to build excellent farm buildings and homes which means that the indirect returns from cattle feeding in Lancaster County has more than paid for the apparent direct financial loss from cattle feeding. If other sections of Pennsylvania had followed this same system of farming there would to-day be fewer worn-out and deserted farms. In feeding steers it is important that as much as possible of the actual gain be made on rough feed. The reason for this is that it is important to provide a market for a large amount of roughage rather than grain feeding. This is especially true in the early part of the feeding period. The more pounds of gain that can be made on feeds of this kind, the greater will be the net returns from the entire feeding operation. The daily gains made by this method of feeding will not be as large as where an abundance of grain is fed soon after the cattle are put in the feed lot. The finish on such cattle, when they go on the market, may not be quite as high as that of those that are fed considerable grain from the beginning, which may mean a somewhat lower price when sold. We find, however, that as a general rule, the cost of making a 100 pounds of gain is less, when roughage alone is fed during the early part of the feeding period, than where grain is fed during the entire period. The table herewith presented brings out this point quite clearly.

Steer Feeding Experiment, 1911-1912.

	Lot I. 12 Steers 126 Days	Lot II. 12 Steers 126 Days
Length of Feeding Period,		
Initial Value per Cwt.,	$5.07	$5.07
Initial Weight,	10,615 lbs.	10,560 lbs.
Final Weight,	13,425 lbs.	13,360 lbs.
Total Gain,	2,810 lbs.	2,800 lbs.
Ave. Daily Gain per Steer,	1.86 lbs.	1.85 lbs.
Ave. Daily Feed per Steer.		
Ear Corn,	13.81 lbs.	7.52 lbs.
Cottonseed Meal,	2.09 lbs.	2.09 lbs.
Corn Silage,	22.54 lbs.	33.33 lbs.
Average Air-Dry Matter Consumed per Steer Daily,	20.76 lbs.	19.86 lbs.
Total Cost of Feed.*	$319.25	$252.64
Cost of Feed per 100 lbs. Gain,*	11.36	9.02
Total Cost of Cattle and Feed,	857.43	788.03
Cost per Cwt. at Close of Expt.,	6.39	5.90
Value per Cwt. in Pgh.,	7.20	7.00
Net Receipts,	875.58	844.35
Total Profit.*	18.15	56.32

Fig. 1. Lot I at the Beginning of the Feeding Period.

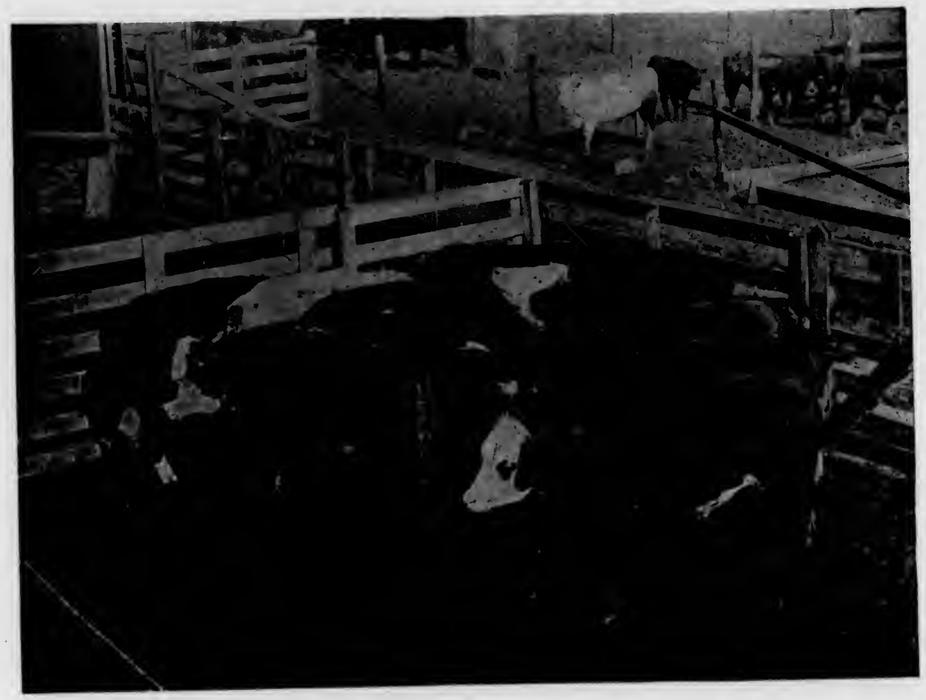
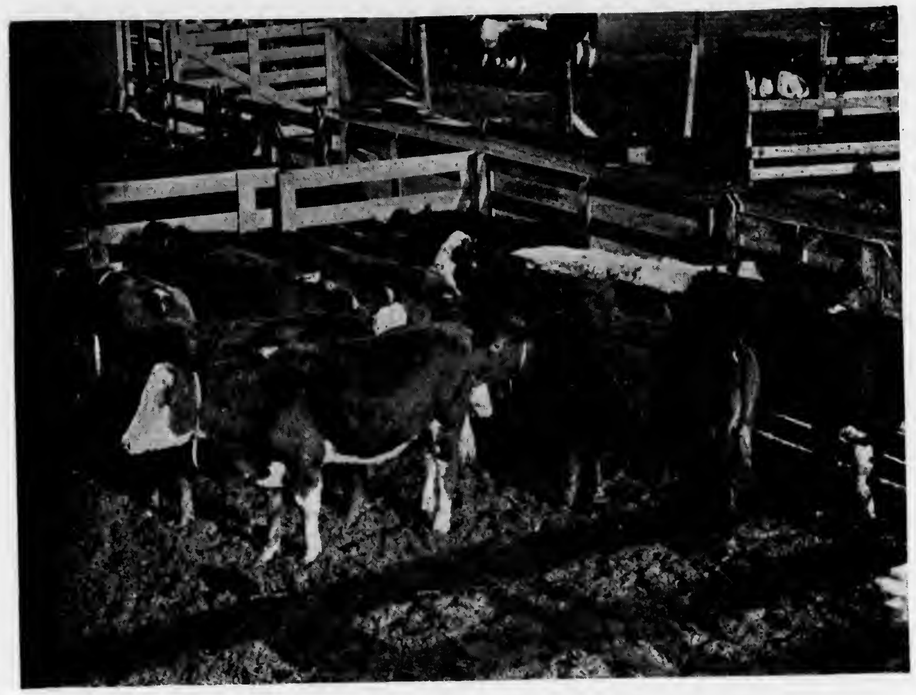


Fig. 2. Lot I at the Close of the Feeding Period.
(Courtesy of Penna. State College.)

Fig. 3. Lot II at the Beginning of the Feeding Period.

Fig. 4. Lot II at the Close of the Feeding Period.
(Courtesy of Penna. State College.)



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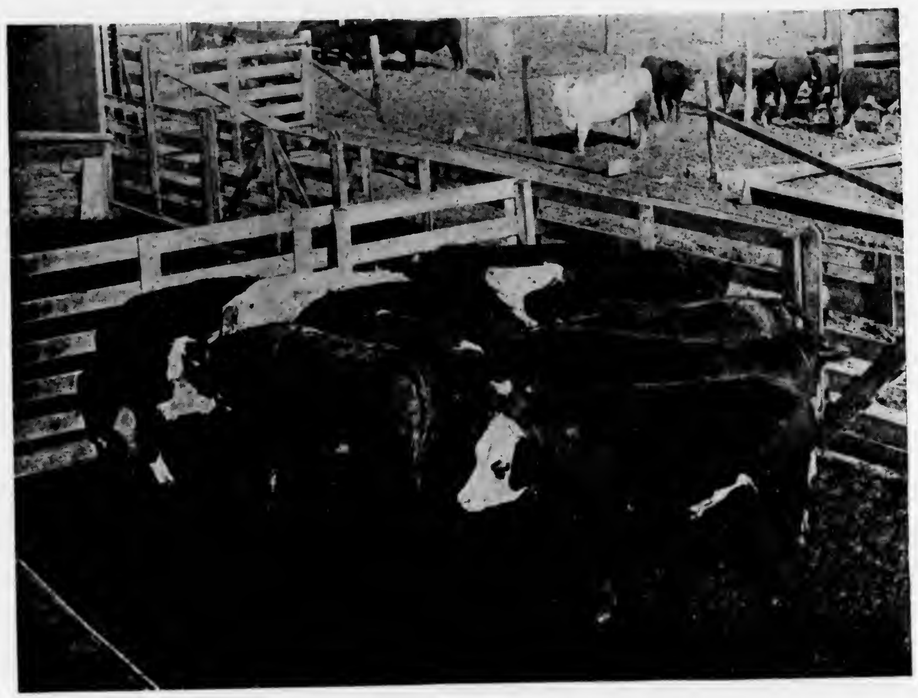

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(Courtesy of Penna. State College.)

Fig. 3. Lot II at the Beginning of the Feeding Period.

Fig. 4. Lot II at the Close of the Feeding Period.
(Courtesy of Penna. State College.)

Price Recd. per Bu. of Corn Fed After Paying for Other Feeds,*	.761	1.046
Price Recd. per Ton for Silage After Paying for Other Feeds,*	4.65	5.73
Value of Manure, ...	31.24	31.24

*Based upon ear corn at 70c. per bushel; cottonseed meal at $32 per ton, and corn silage at $3.50 per ton.

As a general rule the higher the price of grain or corn is, the more important it is that much of the gain is made on roughage. We find that light weight steers weighing about 900 pounds can be fed to an advantage for a period of about two months without very much grain, after which time it is desirable to add grain to the ration. Unless grain is added at this time we find that the daily gains are materially decreased and the cost of producing a pound of gain materially increases.

We find that silage is an important factor in steer feeding. In all tests conducted at the Pennsylvania State College and other institutions, the results obtained are, in almost every, in favor of feeding corn silage. We find that cattle not only makes better gains when silage is fed, but they also make better use of the feeds fed in connection with the silage. Our practice has been to feed the steers all the corn silage that they will consume during the early part of the feeding period. It is desirable to add a small amount of hay or straw to supply the system with some kind of dry feed which it demands. In addition to the corn silage and hay we plan to give our cattle about two and one-half pounds of cottonseed meal per 1,000 pounds live weight. This is necessary in order to supply the protein necessary and there is no feed that is as rich in protein as cottonseed meal. It is possible, however, that we may be able to find a desirable substitute for cottonseed meal in alfalfa. We are conducting a test at the college this winter to determine this point. If this can be done it will mean a greater field for the production of alfalfa and a source of securing protein feeds on the farm instead of purchasing it on the market. Another reason why this might be desirable is that cottonseed meal will possibly continue to increase in price and become more expensive from year to year. When roughage and cottonseed meal are fed during the first part of the feeding period only, it is desirable to add corn to the ration during the last half of the feeding period or until they are sold. This is generally done by adding broken ear corn at the rate of 15 pounds per 1,000 pounds live weight. For finishing cattle we find it desirable to add shelled corn in place of broken ear corn as the cattle will begin to shell the corn from the cob after it becomes hard and dry. The shelled corn is relished to a greater extent than the broken ear corn. In some sections of Pennsylvania the common practice in steer feeding is to grind the ear corn. This makes the corn more expensive and the additional gains made from the use of ground corn will not pay for the cost of grinding. The

object in every case should be to keep the cost of feed as low as possible.

Shelter.

The cost of shelter is, in many cases, an expensive item. Inexpensive open sheds are to be preferred to warm basement barns. The common mistake made in many cases of cattle feeding is to confine them to warm stables. The only thing necessary is to have the cattle protected from the cold winds, rain and snow. This can easily be done by the use of open sheds with a small yard so that the cattle can go under cover or out in the open at will. Where a basement barn is on the farm it is not necessary to have this stand idle and not use made of it. A part of the wall can be removed or the doors left open so that the cattle can go in and out at will. By this practice the amount of labor in handling the cattle can also be materially reduced. The advantage of keeping steers in open sheds in preference to warm basement barns, may be cited from experiments conducted at the Pennsylvania State College. A series of tests were conducted comparing open sheds with warm barns. It was found that six out of seven years the cattle in the open sheds made better gains, consumed the greater amount of feed, and sold for a higher price than those that were kept in warm basement barns, each lot being fed similarly. The following figures taken from the experiment conducted in 1910 and 1911 will give some idea of the difference in these two methods of feeding.

1910-1911.

	Barn Lot Gained	Open Lot
Cost per 100 lbs. Gain, ...	$11.05	$10.03
Daily Gain in lbs., ...	2.136	2.362
Final Cost per Cwt., ...	$6.63	$6.46
Final Value per Cwt., ...	7.60	7.75
Profit per Steer, ...	10.69	14.67
Return per Bu. Corn, ...	.99	1.108

From this table it will be noted that not only were cheaper gains made in the open lot, but practically every other item involved were in favor of the open lot.

Cattle feeding cannot, as a rule, be profitably conducted unless hogs are put in the lot to follow cattle and consume the waste. Cattle feeders feel that if they can have the profits from pork produced in the feed lot besides the cost of feeding their cattle, that they have made reasonable profit. These hogs will consume all waste and corn that passes through the cattle undigested. As an indication of the additional profits that may be made by having hogs in the feed lot might be cited the results of cattle feeding at the Pennsylvania State College last year. It was found that after a profit of $14.00 and $11.00 respectively per steer, had been made in the two lots, that an additional profit of $2.25 per steer was made from the pork produced. It is customary to allow but two

hogs for every three steers. In some cases it may be necessary to feed them a little in addition to what they pick up in the feed lot. No farmer can afford however, to feed cattle without the use of hogs and where hogs follow the cattle there is no occasion to grind the corn which the steers receive.

The feeding of beef cattle is not a scheme whereby large amounts of money can be made in a comparatively short time and the only way to make a profit is to be a consistent feeder. Have steers in the feed lot the good years as well as the poor years. When such is the case, the average for a number of years will show a balance on the right side of the ledger. It also means a steady market for crops that in many cases are practically unsaleable besides much of the feed consumed by the cattle would possibly go to waste on a farm for want of a suitable market. Besides returning a reasonable profit from year to year, it means that the fertility of the soil is retained. Experience shows that wherever cattle feeding is a part of the business of farming, the farm is kept in a higher state of fertility and generally the highest type of farming is conducted. It insures continued prosperity and means a greater production of farm crops from year to year. Records show that cattle feeding centers and large crop yields are generally closely associated. In this brief discussion I have tried to point out some of the advantages of beef production in the east.

FIG. 8.—A, 2-1, 3-Tier Pack in Georgia Crate.

THE PRESENT AND FUTURE OF APPLE GROWING.

MR. S. H. FULTON, *Manager Sleepy Creek Orchards, Sleepy Creek, W. Va.*

Within the past twenty-five years apple growing has become one of the great branches of agriculture in this country eclipsing, in area of orchards planted and in quantity of fruit produced, all other fruits common to the temperate zone. The attractiveness of this fruit, the palatibility and its health-giving properties together with the fact that it is in season practically the year around, all combine to make the apple the greatest single asset of American horticulture. When the census of 1910 was taken, there were 151,323,000 apple trees of bearing age in the United States. Among the states of the Union, Missouri ranks first, having in round numbers, 14,000,000 bearing trees; New York stands next with 11,000,000; Illinois third with 10,000,000 bearing trees and so on down the list. With such vast interests in apple growing, it is not surprising that anything pertaining to the culture of this fruit is of keen interest not alone to rural horticultural circles but even to town and city people with money to invest. Within the past decade, hundreds of people unacquainted with the orchard business, but allured by tales of great profit in orcharding, have invested large sums of money in apple orchards. This is particularly true with reference to orchards located in sections where large areas of cheap undeveloped land can be secured, as in the Virginias, Western Maryland, southwest Pennsylvania, and sections of other states which might be mentioned. In Maryland, within forty miles of the home of the writer, one company is developing in apple orchards an immense tract of 40,000 acres and selling in ten acre units to investors all over this country and abroad. The published circulars of this company are so alluring and the salesmen so enthusiastic over the orchard business that sales have been made much faster than the land can be cleared and planted. Plantings by practical individual growers and close corporation companies with good managers have also been very extensive within the past ten years. In the sections above mentioned young well cared for orchards of from 200 to 500 acres are not uncommon. In addition to these heavy eastern plantings, the middle west and the Pacific northwest must also be taken in consideration. In these latter sections there has been unprecedented activity in the planting and development of apple orchards within the past few years.

This brief review of existing conditions serves to bring practical apple growers face to face with the fact that competition will shortly become keener and marketing problems will become more difficult. Of course not all these vast plantings will ever come into bearing, but the next few years will witness a great increase

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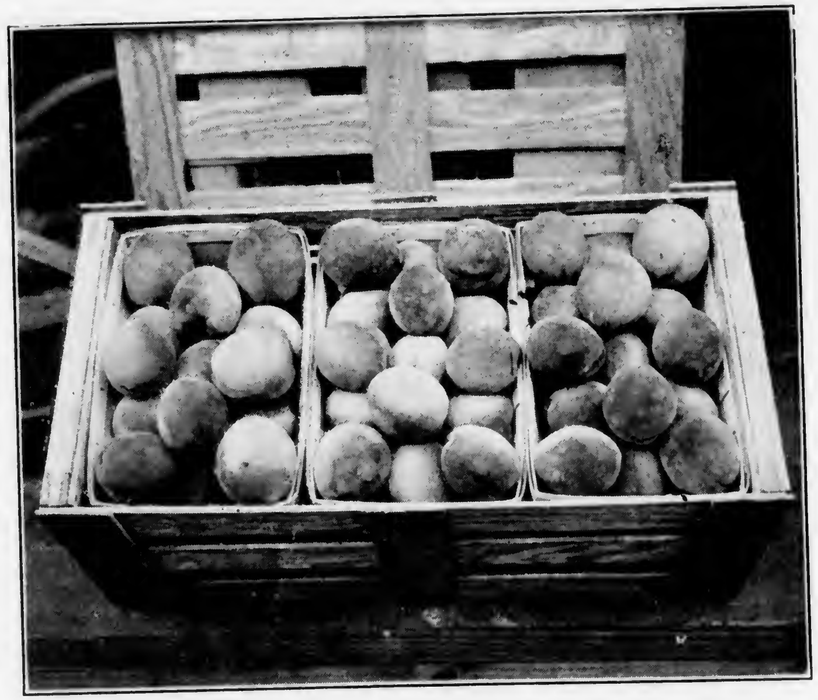

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This brief review of existing conditions serves to bring practical apple growers face to face with the fact that competition will shortly become keener and marketing problems will become more difficult. Of course not all these vast plantings will ever come into bearing, but the next few years will witness a great increase

in the number of bearing trees of the country and we must prepare to meet the conditions. In this coming era of close competition, certain essential points in orcharding should be kept fixed in the growers' mind. There will not be space in this brief paper to enter into the details of the many problems surrounding the apple business from the time the ground is prepared and trees planted until the orchard is brought into bearing and the fruit placed in the hands of the consumer, so the writer will touch only upon a few vital points relating to the apple industry.

One important question is that of varieties. Advertising schemes and plans to educate the people to eat more apples are beginning to bring results. But in addition to consuming more fruit, the public is beginning to recognize the fact that all apples are not Baldwins, Northern Spy or even Ben Davis. They begin to realize that some apples are better than others and they demand the better varieties. Ten years ago when we made our largest planting of apples, we in common with other growers of the eastern Pan Handle of West Virginia, planted heavily with York Imperial and Ben Davis. We also planted in a more limited way, Grimes Golden and three varieties of summer and fall apples. Grimes Golden was then considered rather a doubtful variety for profit. At that time York Imperial and Ben Davis sold on a par, while buyers took Grimes Golden reluctantly at about twenty-five cents less per barrel than was paid for other varieties. This past season the prevailing price for Ben Davis was $2.75, for York Imperial, $3.25, and for Grimes Golden, $4.00 per barrel. In other words, York Imperial brought fifty cents and Grimes Golden, $1.25 more per barrel than Ben Davis. It should be stated, however, with reference to varieties that many apples of high quality are poor bearers and some possess constitutional weakness in the tree. On the other hand many of the medium and low quality varieties are strong and hearty in tree and abundant bearers. Under these circumstances, it may pay the commercial grower better to raise large quantities of medium quality apples at a fair price than to produce a limited quantity of high class fruit at a high price. Whether the crop is to be sold on the open market or to the retail trade should also be taken into consideration. Low quality apples can often be sold to advantage on the open market but would be rejected by the retail trade. This season in shipping on orders to mountain towns in West Virginia and Maryland, we found it very difficult to dispose of Ben Davis while other varieties sold readily. Were we to be dependent upon the retail trade, we would commence next spring to graft over all our Ben Davis trees. It is possible that changing conditions of the general market may yet bring us to this point.

In a good many fruit growing sections apples which are in season during late fall and early winter are not receiving as much attention as they should. After peaches, pears, plums and other summer fruits are gone, there is a demand, poorly supplied in most

markets, for good eating apples. It is a mistake to try to meet this demand with hard fleshed winter apples unfit for immediate use. Rambo, Wealthy, Maiden Blush, McIntosh and other excellent varieties of this season furnish a list from which the grower may select.

In the eastern fruit belt of West Virginia pruning is one of our big problems. This very important operation in the up-keep of an orchard is apt to be neglected out right or at least receive little attention. Doubtless the pruning problem also is, or should be a serious consideration with Adams County apple growers. The style of pruning, that is, whether the tree shall be trained with open head, closed head with central shaft or leader, two-story, or to some other recognized form does not matter greatly, provided the style once adopted is adhered to year after year. However, the extent to which apple trees are pruned does matter greatly. Unless the tops are kept sufficiently thinned and open to admit plenty of light and air, the fruit will be poorly colored, unattractive in appearance and in the case of certain varieties, very much inclined to scald in cold storage. Personally, the writer likes low open centered trees because of the increased area of the top exposed to light and air and because of convenience in pruning, spraying and harvesting the crop.

Spraying, cultivating, and fertilizing are all operations demanding careful attention on the part of apple growers but these topics have been discussed by other speakers and will be passed over by the writer of this paper. It might be stated, however, in passing, relative to cultivation that a practical orchard tractor should prove a valuable acquisition to the grower whose orchards are extensive enough to justify the necessary outlay. A number of manufacturers, at the present time, have gasoline and oil tractors on the market designed for farm and orchard work but most of these outfits are not fully adapted to the needs of the practical grower and furthermore the price is so high, in most instances, as to be considered prohibitive by most orchardists. A few hours work with a tractor in low headed, closely planted trees will convince any one that under such conditions, a tractor to work successfully must be low and compact with short wheel base capable of turning in a short space. The wheels should be broad and well cleated for work on soft ground, and the engine should not develop less than 15 horse-power at the draw bar. Some makes of tractors approach these specifications, but most of them are built too high and require too much space for turning. The usual price of from two to three thousand dollars is beyond the reach of the great majority of apple growers. A practical working outfit, at a cost not to exceed ten or twelve hundred dollars, would appeal to growers generally throughout the country to supplement and to a certain extent take the place of horses and mules. The automobile and motor truck are practical where roads are good and prices are no longer excessive. These modern inventions are in use by a good

many fruit growers in various parts of the country. It is to be hoped that the orchard tractor will shortly be gotten down to a practical working basis and the price materially reduced. In the rush of spring work it is often impossible to get the orchard land worked over in good time with horses and mules, and, furthermore, teams are necessarily idle a good share of the year on the average fruit farm while expenses for feed and care go on just the same.

In harvesting, winter apples should be allowed to hang upon the trees until well colored and fully developed. This will insure attractive appearance and good keeping quality. Practically all of the decay which occurs in stored apples in the early part of the winter, is due to injuries in handling. The unbroken skin of a sound winter apple is very resistant to rot but once the skin is broken or punctured, rot spores gain entrance and decay results. Careful handling is particularly essential in box packing as the box is designed for fancy fruit and freedom from punctures or bruises is very necessary.

Ordinary barrel packing is usually done in the orchard just as the fruit is picked. Occasionally the apples are hauled to some central point or to a packing shed and there packed in barrels but this practice is not common. For box packing, however, a packing shed of some kind is very necessary. Facilities must be at hand for convenience in grading and wrapping and all needed supplies such as box materials, wrapping paper, box liners, labels, etc., must be kept under cover. This means hauling the fruit to the packing shed and the wagons used for the purpose should be low down and equipped with bolster springs. Round, drop handle, half-bushel picking baskets are very convenient for use in picking and hauling to the packing shed.

Careful systematic work is essential in packing both barrels and boxes. In facing apple barrels the selection of specimens of uniform size so that it will require just so many apples of a certain grade to face a barrel, will facilitate the work and add to the attractiveness of the package. In box packing systematic work is the only kind that will be worth considering. A certain number of apples in each layer and in each row of the layer is absolutely necessary so that the box when completed will contain a fixed number depending upon the size of fruit adapted to any one of the standard packs in common use. This means careful grading. Box packing tables can be obtained through a number of the experiment stations and once the style of pack for a given size of fruit is learned, the work becomes fairly easy and is a pleasure to the packers. Home help can soon be broken in to the work though it will require considerable practice to acquire speed in handling the wrappers. In West Virginia, we have found expert Florida packers who come to our section to pack peaches very efficient for box apple packing. Being skilled in the wrapping and packing of tomatoes and oranges, they quickly learn the various apple packs and acquire good speed with a single day's practice. These packers work their way northward after the tomato season is over in late spring in Florida. The usual wages paid these packers is two dollars per day with board and lodging and railroad fare one way from the point at which they last worked.

Box packing calls for wrappers, box lining paper, layer paper, labels, a convenient packing table and a box press. It will not pay one to attempt box packing on any extended scale without all necessary supplies and equipment.

Within recent years there has been considerable agitation in eastern apple growing sections relative to the box versus the barrel for apple packing. In reality there should be no controversy. Tender-fleshed varieties of high quality are better adapted to box packing than to barrel packing. . On the other hand firm fleshed apples of only fair quality are best suited for barrel packing. Whether to use boxes or barrels is a question for the individual growers to decide. If he finds he can realize more for his apples packed in boxes than in barrels, then the box is the package for him to use. This past season we packed our Wealthy, Jonathan and Grimes Golden in boxes to very good advantage. When it came to York Imperial and Ben Davis we dropped the box and used the barrel as these varieties did not go well in boxes. The barrel commends itself highly to the man who has large quantities of medium grade fruit to handle and who must depend upon inexperienced help for packers. Doubtless the barrel will continue to be the package generally used for the great bulk of eastern grown apples.

Marketing is one of the greatest problems which confront the average apple grower. Growers not infrequently produce good crops of well-grown fruit and yet fail to realize profitable returns because of unfavorable conditions at marketing time or because of improper methods of handling. Usually the apple crop is sold on the trees on the basis of so much per barrel delivered at the railroad station, the grower to furnish the barrel and do the picking and packing under the supervision of the buyer or his representative. This simplifies marketing very much and the fact that this method has become a general practice is an indication that it has been found, at least, a fairly satisfactory system. Winter apples at harvesting time are not in condition to be put on the market for immediate use. The grower must either store his fruit and hold it until ready for consumption or sell to some buyer who stores for later marketing. Usually the grower needs the money for paying his package and labor bills and prefers to realize at once by selling his crop at harvesting time. He generally feels also that he does not wish to take chances on a rise in the market during the winter months and does not like to face cold storage and re-packing charges incidental to storing the crop. However, if prices are low at harvesting time or if for other reasons the grower concludes to handle and market his own crop his problems are greatly multiplied. He must pack for the needs of a retail trade; he must be prepared to meet competition, he must advertise, he must know when to sell,

he must collect his bills from a number of individuals and firms instead of from one firm. This system of marketing while it is more taxing on the grower usually secures wider distribution of the crop and better prices and if practiced to any considerable extent redounds to the benefit of the whole apple industry. Wider distribution and the supplying of small towns not accustomed to securing a regular supply of apples will aid in solving the problem of over production in full crop years.

The future of apple growing is a matter of no small concern at the present time to practical orchardists in this country. Overproduction, the ghost which at times haunts the minds of many fruit growers, looms up big in the hazy future. With thousands of acres recently planted in all parts of the country and millions of young apple trees developing, it would at first thought seem impossible ever to market at a profit to the grower, the great quantities of apples which seem likely to be produced within the next ten years. However, it should be borne in mind that not all the orchards conceived in enthusiasm and planted with dreams of great profits in the near future will ever come into bearing. Apple growing has been boomed too much both for the good of the orchardist and the man with money to invest. The idea of large profits has been exploited with little or nothing said of the failures in the business thereby bringing about, in many instances, blasted hopes and an extravagant waste of money. Already reaction is beginning to set in and fewer orchards are being planted than were set out from three to five years ago. Inexperienced companies and individuals are beginning to learn that it takes money to plant and develop an apple orchard. The writer has in mind a young orchard of two hundred acres finely situated in his vicinity which was entirely abandoned this past summer because the company owning this property ran out of funds and were unable to secure more money. From the vast unit system plantings of promotion companies, we have little to fear. Usually the management is very poor so far as the upkeep of the orchard is concerned and the whole scheme is impracticable so far as raising fruit is concerned. However, the increased planting of experienced individuals and well-financed companies with efficient management will doubtless swell the production of apples in this country with the next few years. We shall probably see some years of low prices, but the practical conservative grower will weather the storm. Low prices will cause the neglect and abandonment of many orchards which are being run on a narrow financial basis. Low prices also will bring about wider distribution and increased consumption. The population of this country is steadily increasing which means greater home consumption and the foreign market for apples is being gradually extended. There came to our shores during the last fiscal year immigrants to the number of 1,197,892. These immigrants consume a good many low grade apples, canned and dried fruit and other cheap products of the apple. Advertising the apple will

help to increase the demand. In this movement the grower can lend his aid and influence. Apple shippers and handlers having designated October 21, as National Apple Day are doing a good work in exploiting the merits of the apple and increasing the demand for this fruit. When apple day came around this fall it was quite generally observed in most of the large eastern cities. Commission houses, restaurants and retail stores made a special effort to center attention on this particular fruit. Many schools in apple-growing regions devoted a portion of the day to special written articles on the apple and in the cities many samples were given to the poor, to orphan asylums and to hospitals. The Chicago papers participated in the celebration, telling the people about the abundance of the fruit and its beneficial effect. In Baltimore about 35,000 apples were distributed among the children in the orphan asylums. In New York, restaurants in the produce districts made a special display of apples cooked in various styles.

Referring again to the heavy planting of apples made within the past few years it should be stated that this great increase is offset to a considerable extent by the decline of hundreds of small orchards scattered over the country. Only a few years ago from many small railroad stations in the older apple producing states such as Maryland, Ohio and Michigan from one to five or more car loads of apples were shipped each fall to the city markets. Now the small farm orchards are gone and no fruit is shipped. This decline has been due to neglect, ravages of the San Jose scale, etc. In the ten years intervening from 1900 to 1910 the United States census showed a decline in bearing apple trees in the United States of from 201,794,000 to 151,323,000 or 33.4 per cent. It will take a considerable share of the newly set trees to offset this decline. The apple business is falling more and more into the hands of the specialist and the man who makes apple growing the dominant feature of his farm operations rather than a side issue.

It rarely happens that we get anything like a full crop of apples in all sections of the country in any one year. This fact also tends to relieve, to a considerable extent, the tenseness of the situation so far as over-production is concerned. In 1896 we had the largest apple crop this country has ever produced. In 1910 the next largest yield occurred. Here was an interval of fourteen years between the two big crops. The well-established grower can withstand an occasional year of big crops and low prices.

High transportation rates and expensive methods of distributing in the large cities militate against the apple business. The grower can unite with the apple shippers and handlers to secure better transportation rates. When the fruit reaches the city on consignment, commission men, jobbers and retailers all take a liberal share of the dollar paid by the consumer, leaving the grower a much smaller fraction than that to which he is entitled. How to eliminate these middlemen is not so apparent. In some instances the grower is in position to deal directly with the retailer or con-

sumer, thereby securing a larger share of the dollar. But, usually he must let his fruit go through the ordinary channels of trade. If the parcel post weight limit is raised and the rate decreased, this will help the grower who is in position to retail some portion of his crop.

On the whole there can be little question but that the apple grower who continues to give his trees good attention through both good and bad years, who produces high class fruit and who grades and packs carefully will continue to find apple-growing profitable. If he is situated within easy reach of the large eastern city markets his chances for success will be greater. With reference to nearness to market, Pennsylvania growers are particularly fortunte and may be able to produce apples at a profit years when more distant sections ship at a loss on account of heavier freight charges.

FIG. 5.—California Fruit Crate.

PROFITABLE PORK PRODUCTION.

PROF. W. H. TOMHAVE, *Department of Animal Husbandry, Pennsylvania State College.*

The production of pork on the farms in the Eastern part of the United States is in the form of a by-product rather than an established business. A greater interest is taken by the farmers of Pennsylvania in hog raising at the present time than any previous time in the history of this state. This is largely due to the prevailing high price for meat products and the comparatively high price at which live hogs have been selling during the past few years. There is a place for the production of pork on practically every farm. This part of the business of farming can be conducted at a very small increase in expenses. There is no class of farm animals from which returns are quicker than from the hog. The reason for this is that they mature very rapidly and can be put on the market when about eight months old.

To be successful in the growing of hogs it is essential that the business be given some consideration and the hogs be properly cared for instead of being allowed to shift for themselves and become the scavengers of the farm.

One of the first questions that arises in the mind of the beginner is what breed of hogs is best for pork production? There is no best breed of hogs. In selecting the breed it will depend quite largely upon the man's personal choice or preference, rather than on any particular breed. It is much more important to select desirable individuals no matter from what breeds they are selected. We find a great many desirable animals among all breeds and an equal number of poor or undesirable individuals. Breed tests have been conducted at Experiment Stations in the United States and Canada, and in no instance has the same breed been a consistent winner, nor has any particular breed excelled in the economy of pork production. This seems to show conclusively that it is more a question of individuality rather than a question of breed. The selection of the breeding stock is of great importance and should be given due consideration. In selecting brood sows, either grade or pure bred, it is important that they come from comparatively large litters as such brood sows generally inherit such characteristics and are more apt to produce large litters than those that come from small litters. The size of the litter is very important because of the initial cost of the pigs at the time of weaning depends upon the number of strong healthy pigs in the litter. The cost of maintaining a brood sow is from $15.00 to $20.00 per year for feed alone, which means that the value at the time of weaning of the small pigs produced is based on what it cost to maintain a brood sow throughout the year. If such a brood sow produces two lit-

ters per year and develops on an average of seven for one litter, the initial cost for each pig about $1.50 at weaning time. If she produces only one litter per year and raises an average of only five pigs per litter, it means that the value at the time of weaning for each one of the pigs from such a litter, is from $3.00 to $4.00 a piece. In selecting the brood sows it is important that they are strong, growthy smooth and uniform individuals. Pigs with too much refinement and too small bone should be ignored in selecting breeding stock. All breeding stock should have a strong well-arched and wide back. This is an indication of strong muscling and an individual that carries a large amount of natural flesh. The sides should be smooth and deep. Wrinkles in the side should be guarded against. These wrinkles are not only on the outside, or as deep as the skin, but extend into the carcass. Wrinkled sides are transmitted from the brood sows to the offspring and are objectionable from the butchers' point of view. Hogs with wrinkled sides will sell for less money on the market than those that are smooth and uniform. The reason for this is that a packer cannot cut number one bacon out of wrinkled sides and must be classed as number two and three which means that it will sell for considerably less on the market than number one bacon. Good strong bone is essential in all breeding stock. Brood sows should stand up well on their feet with strong pasterns. If they are weak in the pasterns, there is a tendency to break down when they mature. These objectionable features are also transmitted from parent to offspring.

The selection of the boar is just as important as the selection of the brood sow. Nothing but pure-bred boars should ever be kept on the place. In producing market hogs it is not necessary to use pure bred sows. Good grade sows quite frequently can be secured for less money and yet will produce as desirable market hogs as pure breds, but progress in breeding cannot be made or herds cannot be well graded up unless pure bred boars are kept on the place. It is also important that the herd boar comes from a large litter as well as the sow. The size of the litter is influenced by the sire as much as from the dams side.

The management of the breeding stock is important part of successful hog growing. The brood sows and boars should be kept in good thrifty condition. The brood sows should receive plenty of good wholesome food, but not enough to make them overly fat. A combination of 10 pounds corn and one pound tankage together with a small amount of alfalfa or clover hay makes a comparatively cheap and effective ration for brood sows during the winter. A combination of about 40 pounds corn, 20 pounds bran, 20 pounds middlings, and 20 pounds oats is a very desirable ration from the point of view of keeping sows in good condition, yet with the present price of feeds it is too expensive and the results obtained are not enough better than those obtained by the use of corn, tankage, clover and alfalfa hay to warrant the additional expenditure. This

same combination of feed is desirable for the herd board. The brood sows, after they have been bred, should gain just slightly in weight up to the time of farrowing.

Exercise.

Exercise for brood sows and herd boars is important. It will keep them in good physical condition besides a much stronger and thriftier litter of pigs is generally produced. It is desirable to have comparatively large yards for the brood sows that are to farrow in the spring. It frequently happens that brood sows, after they have been bred, become lazy and will take very little exercise unless they are forced to do so. In such cases, we plan to feed them some distance from the place where they are sheltered. This will compel them to take exercise every day in order to get to their feed.

Shelter.

One of the aims in profitable pork production is to reduce the cost of shelter to the minimum. Expensive hog houses are not always desirable. While they may be convenient, it materially increases the cost of maintaining a herd of brood sows. We find the hog cots or "A" shaped houses to give entire satisfaction. These can be built from $12 to $20 apiece and made large enough to house several sows each during the winter. If they become too cold they can be banked up with straw which will make them quite comfortable. Straw sheds that are dry with plenty of bedding in them are also found to give entire satisfaction.

Farrowing Time.

If early spring pigs are desired it is important to have a desirable place in which the sows can farrow. This may necessitate the building of a small hog house for this purpose. It is important that each brood sow be by herself when she farrows. The hog cots can be used if it is not too cold. If it is very cold a lantern may be hung in the cot which materially increases the temperature. It is also important that the place for the brood sow to farrow be dry with a small amount of dry, clean straw that is free from dust. Dusty bedding is very objectionable and very often causes the young pigs to cough which is due to the irritation from the dust inhaled. The farrowing pens should be fitted out with a rail about six inches from the floor nailed to the wall so as to keep the sow from killing the young pigs by lying on them. This rail will serve as a protection. The feeding of the brood sow at farrowing time is very important. It is well to reduce her feed to about half the amount commonly fed two or three days before farrowing. She should receive no feed the first 24 or 36 hours after farrowing with

the possible exception of a handful of meal thrown in some lukewarm water. The brood sow does not require feed at this time because her system is in a feverish condition and she will gain her normal condition much quicker if feed is withheld.

Permit her to drink all the lukewarm water she cares to. It also avopids the danger of caked udders or milk fever in the more prolific or heavy milk-producing brood sows. At the end of 36 hours, gradually increase her feed so that she is back on full feed at the end of a week or ten days. She should be fed the same combination of feed after farrowing as was fed before she farrowed, although the amount can be somewhat increased depending upon the number of pigs that she nurses and her body condition.

Handling of the Small Pigs.

The small pigs should be taught to eat just as soon as they can be induced to do so. If sweet skim milk can be obtained it is a good plan to give them a small amount of this in a trough where the brood sow does not get at it and they will begin to consume it at a surprisingly early age. A small amount of wheat middlings or oats with the hull sifted out can be added to the milk to advantage. If milk cannot be had, a small amount of lukewarm water with a little middlings or oats in it should be fed. By handling the small pigs in the manner mentioned they will become accustomed to taking more feed besides that obtained from the brood sow and they will also make quicker growth. It not only means a better developed pig, but it gets them in better condition for weaning. It is a serious mistake to wean pigs when they are 6 to 8 weeks old by taking them away from the brood sow before they are beginning to eat. Such a practice has a tendency to stunt the growth of the young pigs because of the fretting and sudden change that has taken place. It is much better to reduce the feed of the brood sow which will have a tendency to reduce the flow of milk and increase the feed for the young pigs, which means that the small pigs will soon wean themselves as they will become entirely dependent upon the feed provided rather than depending upon the brood sow.

Developing Young Pigs.

In developing young pigs that are to be used for breeding or for market it is important that the gains are made as cheaply and as rapidly as possible. In this connection it is extremely important that pasture of some kind be provided in addition to the grain fed. Experiments conducted at the Pennsylvania State College and other institutions show that not only can gains be made cheaper, but heavier gains are made where the young pigs have access to plenty of good clover alfalfa or some other annual crop in the form of pasture. Developing young pigs in a dry lot is expensive, besides it takes a longer period of time to put them on the market. In

addition to the pasture provided, these young pigs should be given a grain mixture made up of 4 or 5 parts corn, 2 parts middlings and one part tankage. The amount of corn to be increased toward the fattening period. When the hogs weigh from 125 pounds to 140 pounds it is advisable to feed them a ration made up largely of corn in addition to a small amount of tankage as a fattening ration. We have found it a desirable practice to take hogs of this weight and practice a method of hogging off corn. That is, to fence off a small field of corn so that they can do their own husking. This may seem like a wasteful method, yet it is a practice that has been carried out very successfully in the central west and regions of Pennsylvania. The best time to market the hogs is when they weigh from 200 to 225 pounds. Such weight is most desirable on the market and hogs of such weight generally sell very near the top when put on the market.

In successful hog growing it is important that the same breed be kept year after year. The reason for this is that the owner becomes more familiar with the peculiarities of the breed the longer he works with them and he will be able to handle the breed better the second and third years and so on, than he did the first year as nothing is gained by changing breeds from one year to another. Another important point to keep in mind is not to sell off the young breeding stock. Retain the brood sow as long as she is in good condition, that is, all good producing sows should be kept on the farm until they are no longer good producers. Investigations along this line show that not only the size of the litter and the weight of the pigs are increased as the sows mature, but the pigs from matured stock will make quicker and better gains than those from young stock.

Adams County Grows Fine Fruit.

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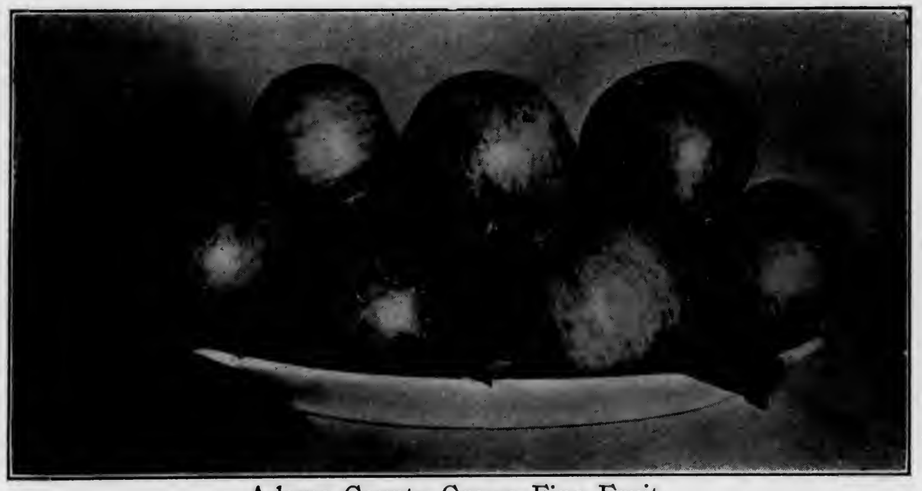

Adams County Grows Fine Fruit.

FRUIT EXHIBIT.

While the fruit shown at this exhibit was of the usual high Adams County quality, it is to be regretted that more members did not participate so that the exhibit should more nearly represent the county as a whole. One hundred and eighteen plates and twelve boxes were shown; six of the boxes being regular commercial pack.

Details of Fruit Exhibit.

W. S. ADAMS—12 PLATES.

6 plates Stayman
3 plates York Imperial
1 plate Pecks Pleasant
1 plate Baldwin
1 plate Smokehouse

C. E. RAFFENSPERGER—13 PLATES.

6 plates York Imperial
2 plates Stayman
3 plates York Stripe
2 plates Smith Cider

H. M. KELLER—23 PLATES.

4 plates York Imperial
5 plates Winter Banana
3 plates Stayman
6 plates York Stripe
2 plates Rome Beauty
3 plates Ben Davis

C. A. WOLFE—15 PLATES.

6 plates Baldwin
6 plates Jonathan
3 plates York Imperial

BOYER BROS.—14 PLATES.

2 plates York Stripe
2 plates Newtown
7 plates York Imperial
2 plates York Stripe
1 plate Paragon

MERZ BROS.—1 PLATE.

1 plate Evaporated Apples

ROBERT GARRETSON—4 PLATES.

2 plates Ben Davis
2 plates York Imperials

GEO. P. MYERS—11 PLATES.

4 plates York Imperial
2 plates Baldwin
1 plate Ben Davis
3 plates For A Name
1 plate Krauser

TYSON BROS.—6 PLATES; 12 BOXES.

3 plates Paragon
3 plates Stayman
1 plate Grimes Golden
1 Box Grimes Golden
1 box York Imperial
1 box York Imperial
9 boxes Stayman

B. F. WILSON—19 PLATES.

3 plates Baldwin
11 plates Jonathan
plates York Imperial

ADAMS COUNTY FRUIT RECORDS

Shipments Over Gettysburg & Harrisburg R. R.

	Year	No. Bbls. shipped In bbls.	No. Bbls. shipped In bulk	No. Bbls. Total	No. Cars Apples (150 Bbls. to Car)	No. Cars Potatoes (500 bus. to Car)	No. Cars Peaches	No. Cars Pears	No. Cars Canned Apples (36000 lbs.)	No. Cars Evaporated Apples (30000 lbs.)	No. Cars Cider Syrup	Other Shipments
Gettysburg, ...	1905	318	333	651	4	1	....	....	....	....	....	.....
G. & H. R. R.,	1906	28	.....	28	...	....	....	....	....	....	....	.....
	1907	127	.....	127	1	....	....	....	....	....	....	.....
	1909	12	.....	12	...	....	....	....	....	....	....	.....
	1910	50	.....	50	...	....	....	....	....	....	....	.....
	1911	41	.....	41	...	....	....	....	....	....	....	.....
	1912	123	.....	123	...	....	....	....	....	....	....	.....
	1913	23	.....	23	...	....	....	....	....	....	....	.....
Biglerville, ...	1903	8813	987	9800	65	....	....	....	....	....	....	.....
	1905	7932	.....	7932	53	2	....	....	....	....	....	.....
	1906	2785	165	2950	20	....	....	....	....	....	....	.....
	1907	17164	4216	21380	142	12	....	....	....	....	....	.....
	1908	4956	.....	4956	33	6	....	....	....	....	....	.....
	1909	10785	137	10922	73	1	....	....	....	....	....	.....
	1910	20017	1500	21517	144	10	....	....	43	5	4	1 car Cherries.
	1911	37897	552	38449	256	....	....	....	100	8	3	.....
	1912	26521	779	27300	182	19	....	1	42	2	4	.....
	1913	32555	450	33005	220	4	....	2	95	2	6	.....
Guernsey, ...	1903	2870	2413	5283	35	....	....	....	....	....	....	.....
	1905	1771	1166	2937	20	11	....	....	....	....	....	.....
	1906	1414	1329	2743	18	2	....	....	....	....	....	.....
	1907	4798	2760	7858	52	15	....	....	....	....	....	.....
	1908	2173	.....	2173	15	7	....	....	....	....	....	.....
	1909	7320	.....	7320	49	5	....	....	....	....	....	.....
	1910	11659	1267	12926	86	12	7	....	....	....	....	.....
	1911	13600	363	13963	93	....	....	½	....	....	....	240 bks. Plums, 650 bks. cherries.
	1912	4713	574	5287	35	3	½	¼	....	....	....	.....
	1913	16213	194	16407	109	3	⅓	½	....	....	....	.....
Bendersville, .	1903	4163	.....	4163	28	....	....	....	....	....	....	.....
	1905	4000	2351	6351	42	16	....	....	....	....	....	.....
	1906	1109	1561	2670	18	20	....	....	....	....	....	.....
	1907	2824	6268	9092	61	22	....	....	....	....	....	.....
	1908	2264	.....	2264	15	21	....	2	....	....	....	.....
	1909	3531	1200	4731	32	15	....	....	....	....	....	.....
	1910	5628	2132	7760	52	30	4	1	....	....	....	.....
	1911	8894	366	9260	62	7	1 ½	3	....	....	....	.....
	1912	4251	946	5197	35	30	4	1	....	3	....	.....
	1913	12390	2175	14565	97	20	....	2	....	3	....	.....
Gardners, ...	1903	997	985	1982	13	....	....	....	....	....	....	.....
	1905	912	5215	6127	41	4	....	....	....	....	....	.....
	1906	.....	.....	.....	...	....	....	2	....	....	....	.....
	1907	6905	5440	12345	82	4	....	1	....	....	....	.....
	1908	433	.....	433	3	1	....	2	....	....	....	.....
	1909	2275	4571	6846	46	....	....	....	....	....	....	.....
	1910	1566	3722	5288	35	1	4	2	....	....	....	.....
	1911	3900	4800	8700	58	....	....	5	....	....	....	.....
	1912	1860	.....	1860	12	6	....	.....	28	....	....	.....
	1913	4295	997	5292	35	1	12	2	62	....	3	.....
Starners, ...	1905	682	1016	1698	11	5	....	....	....	....	....	.....
	1906	664	133	797	5	4	....	....	....	....	....	.....
	1907	1572	219	1791	12	3	....	....	....	....	....	.....
	1908	487	.....	487	3	3	....	....	....	....	....	.....
	1909	1825	8	1833	12	4	....	....	....	....	....	.....
	1910	2500	2192	4692	31	3	2	....	....	....	....	.....
	1911	2018	668	2686	18	2	⅓	½	....	....	....	.....
	1912	2000	563	2563	17	18	½	½	....	....	....	.....
	1913	2290	150	2440	16	6	8	1	....	....	....	.....

Adams County Fruit Records

Shipments Over Gettysburg & Harrisburg R. R.— *Continued*)

	Year	No. Bbls. shipped In bbls.	No. Bbls. shipped In bulk	No. Bbls. Total	No. Cars Apples (150 Bbls. to Car)	No. Cars Potatoes (500 bus. to Car)	No. Cars Peaches	No. Cars Pears	No. Cars Canned Apples (36000 lbs.)	No. Cars Evaporated Apples (30000 lbs.)	No. Cars Cider Syrup	Other Shipments
Hunters Run,.. Including Goodyear	1903	625	.....	625	4	....	....	....	....	....	....	.....
	1905	160	160	320	2	8	....	....	....	....	....	.....
	1906	295	262	557	4	5	....	....	....	....	....	.....
	1907	1417	514	1931	13	12	....	....	....	....	....	.....
	1908	1704	.....	1704	11	1	....	1	....	....	....	.....
	1909	1289	510	1799	12	1	....	....	....	....	....	.....
	1910	2103	2190	4293	29	1	1	1	....	....	....	.....
	1911	3750	300	4050	27	....	....	....	....	....	....	.....
	1912	2040	.....	2040	14	....	....	....	....	....	....	.....
	1913	3045	.....	3045	20	⅓	....	1	....	....	....	.....
G. & H. R. R., Total	1903	17468	4385	21853	146	....	....	....	....	....	....	.....
	1905	15617	9908	25525	170	47	....	....	....	....	....	.....
	1906	6295	3450	9745	65	35	....	2	....	....	....	.....
	1907	34797	19217	54014	360	56	....	1	....	....	....	.....
	1908	12017	.....	12017	80	39	....	4	....	....	....	.....
	1909	27037	6426	33463	223	26	....	....	....	....	....	.....
	1910	43523	13003	56526	377	57	17	3	43	5	4	1 car Cherries,
	1911	70100	7049	77149	514	9	2	9	100	8	3	240 bks. Plums, 650 bks. Cherries.
	1912	41508	2862	44370	296	76	5	4	70	5	4	.....
	1913	70748	3966	74714	497	34	20	9	157	5	9	.....

Shipments Over Western Maryland R. R.

	Year	No. Bbls. shipped In bbls.	No. Bbls. shipped In bulk	No. Bbls. Total	No. Cars Apples (150 Bbls. to Car)	No. Cars Potatoes (500 bus. to Car)	No. Cars Peaches	No. Cars Pears	No. Cars Canned Apples (36000 lbs.)	No. Cars Cider Syrup	Other Shipments
Virginia Mills, ...	1907	320	8800	9120	61	....	....	....	....	....	.....
	1908	.....	1620	1620	11	1	....	....	....	....	.....
	1909	326	1519	1845	12	....	....	....	....	....	.....
	1910	.....	30	30	....	....	....	....	....	....	.....
	1911	.....	.....	.....	....	....	....	....	....	....	.....
	1912	300	.....	300	2	4	....	....	....	....	.....
	1913	60	.....	60	....	....	....	....	....	....	.....
Jack's Mountain, .	1913	352	.....	352	2	1	....	....	....	....	.....
Orrtanna, ...	1903	3300	.....	3300	22	....	....	....	....	....	.....
	1905	1062	.....	1062	7	....	....	....	....	....	.....
	1906	3659	.....	3659	24	....	....	....	....	....	.....
	1907	3177	2342	5519	37	1	....	....	....	....	.....
	1908	2686	1020	3706	25	....	....	....	....	....	.....
	1909	741	840	1581	10	....	....	....	....	....	.....
	1910	8216	4045	12261	82	½	....	....	....	....	.....
	1911	7043	3846	10889	73	....	1	....	....	....	.....
	1912	8412	2798	11710	78	1	3	....	....	....	.....
	1913	12897	154	13051	87	¼	....	⅓	32	2	.....

Adams County Fruit Record

Shipments Over Western Maryland R. R.—(*Continued*)

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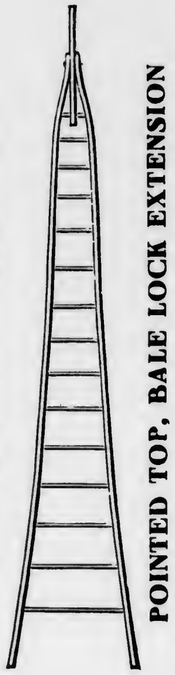
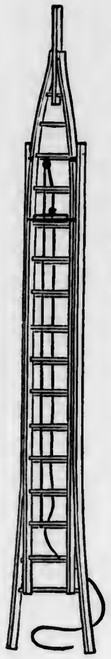
McKnightstown, ..	1903	3438	.....	3438	23	....	....	....	....	....	.....
	1905	7895	178	8073	54	1	....	....	....	....	.....
	1906	2296	254	2550	17	⅙	....	....	....	....	.....
	1907	3393	1155	4548	30	3	....	....	....	....	.....
	1908	1785	251	2036	13	....	....	....	....	....	.....
	1909	7724	2030	9754	65	⅓	....	....	....	....	.....
	1910	14275	1800	16075	107	2	....	....	....	....	.....
	1911	26297	2231	28528	190	¼	....	1	....	....	.....
	1912	4122	520	4642	31	2	....	....	....	....	40 bus. Pears.
	1913	13000	.....	13000	87	....	....	....	....	....	30 bus. Peaches, 20 bus. Pears.
Other W. M. R., .. Stations West of Gettysburg	1906	328	.....	328	2	2	....	....	....	....	.....
	1907	745	618	1365	9	2	....	....	....	....	.....
	1908	42	.....	42	....	....	....	....	....	....	.....
	1909	50	.....	50	....	....	....	....	....	....	.....
	1910	26	564	590	4	4	....	....	....	....	.....
	1911	223	400	623	4	....	....	....	....	....	.....
	1912	48	.....	48	½	....	....	....	....	....	50 bus. Pears.
	1913	56	.....	56	1-3	....	....	....	....	....	.....
Gettysburg, ...	1906	13	.....	13	....	....	....	....	....	....	.....
	1907	18	.....	18	....	....	....	....	....	....	.....
	1908	23	.....	23	....	....	....	....	....	....	.....
	1909	22	.....	22	....	....	....	....	....	....	.....
	1910	428	.....	428	3	....	....	....	....	....	.....
	1911	36	.....	36	....	½	....	....	....	....	.....
	1912	42	.....	42	....	....	....	....	....	....	.....
	1913	52	.....	52	⅓	....	....	....	....	....	.....
Granite, ...	1912	400	.....	400	2	....	....	....	....	....	.....
	1913	102	.....	102	1	....	....	....	....	....	.....
New Oxford, ...	1907	.....	1033	1033	7	....	....	....	....	....	.....
	1908	.....	.....	.....	....	....	....	....	....	....	.....
	1909	.....	276	276	2	....	....	....	....	....	.....
	1910	.....	695	695	4¾	....	....	....	....	....	.....
	1911	390	.....	390	2½	....	....	....	....	....	.....
	1912	275	152	427	3	....	....	....	....	....	.....
	1913	300	.....	300	2	....	....	....	....	....	.....
East Berlin, ...	1905	50	.....	50	....	....	....	....	....	....	.....
	1906	1140	1193	2333	15	⅓	....	....	....	....	.....
	1907	49	.....	49	....	½	....	....	....	....	.....
	1908	.....	.....	.....	....	....	....	....	....	....	.....
	1909	10	205	215	2	....	....	....	....	....	.....
	1910	1	1	2	....	....	....	....	....	....	.....
	1911	18	160	178	1	....	....	....	....	....	.....
	1912	.....	80	80	½	....	....	....	....	....	.....
	1913	.....	.....	.....	....	....	....	....	....	....	.....
W. M. R. R., ... Total	1903	6738	.....	6738	45	....	....	....	....	....	.....
	1905	10380	1320	11700	78	5	....	....	....	....	.....
	1906	7447	1447	8894	59	3	....	....	....	....	.....
	1907	7720	13948	21668	144	7	....	....	....	....	.....
	1908	4536	2891	7427	49	1	....	....	....	....	.....
	1909	8873	4870	13743	91	⅓	....	....	....	....	.....
	1910	22946	7135	30081	201	2½	....	....	....	....	.....
	1911	33959	6637	40596	270	1¼	1	1	....	....	.....
	1912	14091	3550	17641	117	3	3	....	....	....	90 bus. Pears.
	1913	26819	154	26973	180	1¼	....	⅓	32	2	30 bus. Peaches, 20 bus. Pears.
Littlestown, ...	1910	450	.....	450	3	2	....	....	....	....	.....
	1911	300	.....	300	2	....	....	....	....	....	.....
	1912	.....	.....	.....	....	5	....	....	....	....	.....
	1913	.....	.....	.....	....	....	....	....	....	....	.....
Dillsburg, ...	1910	300	.....	300	2	....	....	....	....	....	.....
	1911	300	.....	300	2	....	....	....	....	....	.....
	1912	.....	.....	.....	....	....	....	....	....	....	.....
	1913	150	.....	150	1	....	....	....	....	....	.....

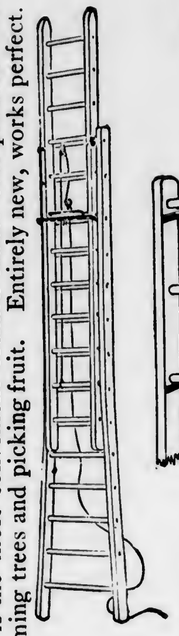
OPEN TOP SINGLE



POINTED TOP, SINGLE LADDER



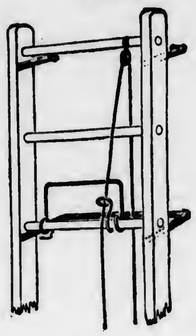
POINTED TOP, BALE LOCK EXTENSION



This is the most convenient orchard ladder ever produced for trimming trees and picking fruit. Entirely new, works perfect.

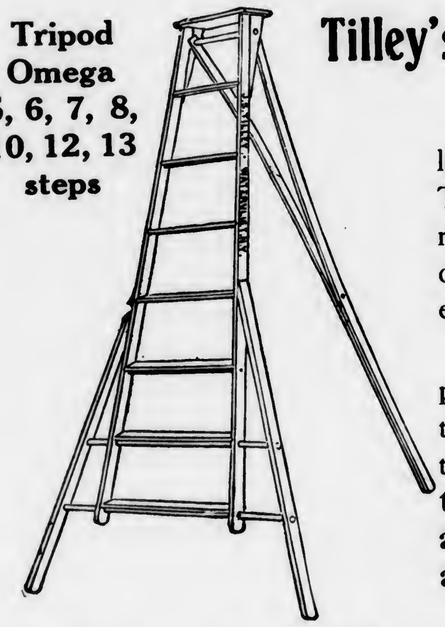
Bale Lock Extension

Quick and Positive



Always keep rope hand close to ladder when operating top section. Pull rope to raise the traveling section. To lower traveling section carry the hand slightly to the right while Bale is in vertical position. To lock it, carry hand to the left, always keeping rope hand close to the ladder and the Bale will drop in position and lock it secure.

Tripod Omega 5, 6, 7, 8, 10, 12, 13 steps



Tilley's Omega Tripod Step Ladder

"First-class in every respect. Stiff, rigid, light and durable. All flat steps to stand on. The two lower steps are supported by, and rest on rounds which tie, support and thoroughly brace the main ladder. Fully covered by patents dated December 26, 1910."

"Beware of false statements from unscrupulous competitors who are trying to force the sale of their inferior goods by intimidation. **The Patentee and Manufacturer is responsible, reliable, able and willing to protect his patrons and himself against bluffers."**

John S. Tilley Ladders Co. Inc.

Manufacturer of Ladders and Step Ladders of every description

Factory, WATERVLIET, N. Y.

REPRESENTED IN PENNSYLVANIA BY

EDWIN C. TYSON, Flora Dale, Pa.

Adams County Fruit Records

Total Fruit Marketed in County

	Year	No. Bbls. shipped In bbls.	No. Bbls. shipped In bulk	No. Bbls. Total	No. Cars Apples (150 Bbls. to Car)	No. Cars Potatoes (500 bus. to Car)	No. Cars Peaches	No. Cars Pears	No. Cars Canned Apples	No. Cars Evaporated Apples	No. Cars Cider Syrup	Other Shipments.
Total Shipped,	1903	24206	4385	28591	191	....	....	....	....	....	....	.....
	1905	25997	11228	37225	248	52	....	....	....	....	....	.....
	1906	13742	4897	18639	124	38	....	2	....	....	....	.....
	1907	42517	33165	75682	504	63	....	1	....	....	....	.....
	1908	16553	2891	19444	129	40	....	4	....	....	....	.....
	1909	35910	11296	47206	314	27	....	....	....	....	....	.....
	1910	67219	20138	87557	583	61½	17	3	43	5	4	Car cherries.
	1911	104659	13686	118345	789	10	3	10	100	8	3	.....
	1912	55599	6412	62011	413	84	8	4	70	5	4	.....
	1913	97567	4120	101687	677	35½	20	9⅓	189	5	11	.....
Evaporated, ...	1903	Equal to 6547		6547 — 44		....	....	....	....	....	....	.....
	1905	"	10670	10670 — 71		....	....	....	....	....	....	.....
	1907	"	8333	8333 — 56		....	....	....	....	....	....	.....
	1908	"	....	....		....	....	....	....	....	....	.....
	1909	"	4666	4666 — 31		....	....	....	....	....	....	.....
	1910	"	8600	8600 — 57		....	....	....	....	....	....	.....
	1911	"	21750	21750— 145		....	....	....	....	....	....	.....
	1912	"	5000	5000 — 33		....	....	....	....	....	....	.....
	1913	"	8933	8933 — 60		....	....	....	....	....	....	.....
Canned, ...	1905	Equal to 2400		2400 — 16		....	....	....	....	....	....	.....
	1907	"	10000	10000 — 67		....	....	....	....	....	....	.....
	1908	"	1673	1673 — 11		....	....	....	....	....	....	.....
	1909	"	12398	12398 — 82		....	....	....	....	....	....	.....
	1910	"	16700	16700— 111		....	....	....	....	....	....	.....
	1911	"	25000	25000— 167		....	....	....	....	....	....	.....
	1912	"	27108	27108— 181		....	....	....	....	....	....	.....
	1913	"	42855	42855— 286		....	....	....	....	....	....	.....
Cider, ...	1907	Equal to 9524		9524 — 63		....	....	....	....	....	....	.....
	1908	"	6670	6670 — 44		....	....	....	....	....	....	.....
	1909	"	5714	5714 — 38		....	....	....	....	....	....	.....
	1910	"	11120	11120 — 74		....	....	....	....	....	....	.....
	1911	"	12500	12500 — 83		....	....	....	....	....	....	.....
	1912	"	8000	8000 — 53		....	....	....	....	....	....	.....
	1913	"	9150	9150 — 61		....	....	....	....	....	....	.....
Total fruit, ...	1903	24206	10932	35138— 234		....	....	....	....	....	....	.....
	1905	25997	24298	50295— 335		52	....	....	....	....	....	.....
	1906	13742	4897	18639— 124		38	....	....	....	....	....	.....
	1907	42517	61022	103539 — 690		63	....	....	....	....	....	.....
	1908	16553	11234	27787— 185		40	....	....	....	....	....	.....
	1909	35910	34074	69984— 465		27	....	....	....	....	....	.....
	1910	67219	56558	123777— 825		61½	....	....	....	....	....	.....
	1911	104659	72936	177595- 1184		10	....	....	....	....	....	.....
	1912	55599	46520	102119— 680		84	....	....	....	....	....	.....
	1913	97567	65058	162625 - 1084		35½	20	9⅓	189	5	11	.....

Comparison of Percentages

Year	Per Cent barreled	Per Cent. sold bulk	Per Cent. evaporated	Per Cent. canned	Per Cent. cider	Per Cent. total fruit compared to 1903
1903	70	12	18	.....	.....	100
1905	52	22	26	.....	.....	143
1907	41	32	8	10	9	295
1909	51	16	7	18	8	200
1910	54	16	7	14	9	356
1911	59	8	12	14	7	500
1912	54	6	5	27	8	344
1913	60	2½	5½	26 ½	5½	466

WHAT BECOMES OF ADAMS COUNTY APPLES.

In the first place do you realize that the quantity of fruit grown in Adams County has increased almost five-fold in the past ten years, and is only just reaching the point where rapid increase may be looked for. Have you noticed, as shown by the fruit records, what a decrease there has been in bulk shipments with a corresponding increase in shipments of manufactured fruit? At the first glance this seems to indicate a lowering in the quality of the crop, resulting in a greater proportion of cull apples, but those of us who have followed the progress of the industry closely, keeping tab on the crop from year to year, know that the increased proportion of canned apples does not mean that more culls are being produced, the contrary being decidedly the case, but that greater care in sorting is now almost universal, and as this second grade fruit is now almost entirely either canned or evaporated, it has practically ceased to enter into competition with our No. 1 fruit.

A survey of 1913 shipments shows that Adams County apples went in solid carloads into fourteen states besides our own, and found their way in smaller lots into many others, and that shipments were made into seven foreign countries, as follows:

Massachusetts	Virginia,	Ohio,	District of Columbia,.
Maryland,	Indiana,	Illinois,	
Michigan,	Kentucky,	South Carolina,	Tennessee,
Mississippi,	Alabama,	Louisiana,	Georgia,
Florida,	New York,	New Jersey,	California,
Connecticut,			

and to England, Scotland and Argentine Republic. Boxed fruit was shipped to France, Germany, Denmark, and Russia.

Of these shipments, New York took between 150 and 200 carloads; over fifty cars were shipped to Philadelphia, seventy-five to Pittsburgh; Memphis took sixty; Baltimore twelve and New Orleans, sixteen cars.

The shipment of boxed fruit to California, France, Germany, Denmark, and Russia is rather interesting, especially so in several cases of duplicate orders. Truly we have the whole world as our market, and can hold it too, if we do our part, packing only choice fruit and putting it up in good shape.

A study of the canned fruit shipments is even more illuminating. It would be reasonable to suppose that most of the canned goods would find a market in nearby cities, but the records show that many other states competed for an opportunity to eat Adams County canned apples, among them being Texas, Minnesota, Maryland, Ohio, Iowa, Nebraska, Illinois, New York, New Jersey, West Virginia, Tennessee, Rhode Island, Massachusetts, Indiana, Vermont, New Hampshire, Louisiana, and District of Columbia.

INDEX.

A

TENTH ANNUAL CONVENTION WILL BE HELD DECEMBER 16, 17, 18, 1914.

Showing Canker Near Root.

Showing Extended Canker and Cracking of Bark.

Showing Canker Near Root.

Showing Extended Canker and Cracking of Bark.

FIG. 1.—Delaware and Jersey Baskets filled with Elberta Peaches.

FIG. 2.—Delaware and Jersey Baskets, with Wooden Covers.

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FIG. 2.—Delaware and Jersey Baskets, with Wooden Covers.

END OF YEAR