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Pennsylvania State Horticultural Association News

PUBLISHED BY THE ASSOCIATION

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Vol. XV. State College, Pa., March, 1938 No. 1

79

Proceedings of the

Seventy-ninth Annual Meeting

Farm Show Building, Harrisburg, Pa.

January 18 and 19, 1938

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State Horticultural Association of Pennsylvania

OFFICERS FOR 1937

President	R. J. Gillan, St. Thomas
Vice President	J. A. Runk, Huntingdon
Secretary	J. U. Ruef, State College
Treasurer	C. B. Snyder, Ephrata

Executive Committee: The above named officers and C. J. Tyson, Gardners; H. M. Anderson, New Park; J. Eric Linde, Orefield; H. F. Hershey, Hamburg.

STANDING COMMITTEES

Legislation and Representatives on Agricultural Council: C. J. Tyson, Ch.; H. S. Nolt, Columbia; R. T. Criswell, Chambersburg, (Representative on Tax Committee).

State Farm Show and Exhibition: John Ruef, State College, Ch.; Paul Thayer, Carlisle; R. C. McDonald, Shippensburg.

Insect Pests: H. N. Worthley, State College, Ch.; H. E. Hodgkiss, State College.

Plant Diseases: H. W. Thurston, State College, Ch.; R. S. Kirby, State College; K. W. Lauer, Harrisburg.

Game Laws: J. A. Runk, Huntingdon, Ch.; Geo. Balthaser, Wernersville; R. H. Bell, Harrisburg.

True-to-Name-Trees: F. N. Fagan, State College, Ch.; G. L. Baugher, Aspers.

Inspection Fund: D. M. James, Bureau of Markets, Harrisburg, Ch.; M. E. Knouse, Peach Glen; C. J. Tyson, Gardners; Norman Davidson, Chambersburg; H. F. Hershey, Hamburg.

PRESIDENT'S ADDRESS

R. J. GILLAN

It is a great pleasure to greet you at this, the 79th meeting of the Pennsylvania State Horticultural Association—notwithstanding to us it has been a year of many experiences both pleasant and unsatisfactory.

One may sometimes wonder why prominent growers spend their time, efforts and money in helping others, but this seems peculiar to fruit growers. However, if we were to possess and enjoy only such things as we personally earned, paid for and deserved, we might be naked, uneducated pests. We enjoy more that which has come from inspired unselfish efforts in the ages; and in playing the game according to the rule, while helping ourselves help some one else who has been less fortunate in material possessions. Much honor to those of super vision and judgment with faith in the industry and fellow growers so to plan, work, and chance the efforts to improve life's work and its rewards. This is growing fruit for more than the money in it.

During the past season this association has been interested in the fruit growers' welfare. It has cooperated with Dr. S. W. Fletcher, Director of Research at the Pennsylvania State College of Agriculture, appointing eight growers as members of an advisory committee to confer with the staff members of the Department of Horticulture in developing a program of investigation that will serve the greatest needs of the fruit industry. This arrangement should result in action on present pressing problems.

Francis Reiter	Allegheny County
Harry Backus	Erie County
Harry Anderson	York County
Martin Slade	Adams County

The members of the committee are:

H. W. Skinner	Franklin County
H. T. Hershey	Berks County
Nelson Lewis	Luzerne County
Guy L. Hayman	Chester County

Other association members were appointed to serve in an advisory capacity in the program of work to be conducted by the research workers at the Arendtsville Laboratory at Arendtsville, Adams County. Three men, an entomologist, a plant pathologist, and a pomologist have been assigned to work out from the laboratory in Franklin, Adams, York and Cumberland Counties.

The combined summer meeting and automobile tour deviated in nature somewhat from that of previous years. The attendance was the largest in years, both at the meetings at State College and at the fruit growers' tour into Franklin and Adams County. The cooperation of the Adams and Franklin County associations should be commended, for the

manner in which they took care of 450 growers on the two day trip.

The selling of apples has been and is a problem, but the association has cooperated in every way possible to make Appalachian Apples Inc., and its advertising program a success. It is to be hoped that Pennsylvania growers will continue to support this program not only with the present number of signers but with a decided increase as the program continues. The advertising of our product should not be a one season event but an annual procedure with every grower cooperating to the utmost.

The association cooperated with the Middle Atlantic Fruit Growers' Conference in Washington, D. C. The meeting was called with the belief that "In union there is strength", for fruit growers of the Middle Atlantic States to promote closer cooperation by discussion of the actions of federal and local states, regarding transportation rates, federal regulations, combatting disease, pests, etc. A permanent organization was set in operation by the directors on January 12th with officers elected and plans for financing.

Visiting the annual Farm Products Show serves three purposes for the average grower—an inspection of the fruit display, the contacting of commercial concerns dealing in materials and equipment used in fruit production, and attending the annual meetings. But if one takes in the show, it is impossible to avoid observing what other lines of agriculture are doing for the boys and girls. Last year while making a tour of the buildings, I obtained the impression that as fruit growers we were doing little to arouse the interest of boys and girls in fruit production. As you know, the first fruit judging contest is being held in the building this year. The secretary informs me that five teams are entered with the following counties represented: Allegheny, Adams, Franklin, Indiana, and Lehigh. After the county eliminations several of the counties listed the winners as associate members of the county societies with all privileges of the adult members.

I realize that fruit growing is interesting but also that it is hard work. As an avocation there should be a let up and time for a good time. We have made arrangements for a banquet, free from speeches or subject matter talks. It is hoped that all will be present to make this event a high light of the annual meetings.

SECRETARY'S REPORT

I do not expect to make a speech and thus use up time allotted to speakers on a program intended to be of assistance to the members of this association. But I do want to take the opportunity to express my appreciation for the cooperation and support received from association members whenever assistance was requested. It is the desire of the execu-

tive committee that the State Horticultural Association of Pennsylvania shall be an organization serving the interests of all fruit growers within the state and cooperating with organizations in other states when the interests of the fruit industry can be benefitted.

I am pleased to report a paid up membership of 870 and according to the treasurer a liberal cash balance with all bills paid to January 1st. This is not the work of the secretary but is due to the increased activities of association members who secured new members, and even contacted manufacturers relative to taking advertising space in the association's "News Letters." Let this be a start toward the goal—"Every fruit grower in Pennsylvania a member of the State Horticultural Association." Certainly this would not be impossible, especially when it is recalled how well the affiliated county societies of Adams and Franklin conducted the summer tour during the latter part of July.

The secretary encourages new members, but is also grateful for suggestions or constructive criticism regarding summer meetings, tours, or the annual winter meetings. All persons have preferences and naturally would prepare a program along the lines of greatest personal interest. This is your association and it is hoped that you will cooperate in making suggestions for the improvement of the association and for service to the growers.

TREASURER'S REPORT 1937

C. B. SNYDER

Financial Statement State Horticultural Association
C. B. Snyder, Treas.

1937	RECEIPTS	
Jan. 21,	Cash Balance on hand	$ 255.94
Feb. 2,	John U. Ruef, membership	115.00
Feb. 10,	John U. Ruef, membership	100.00
Feb. 10,	Lanc. Co. Fruit Growers	40.00
Feb. 27,	State Bee Keepers Association	9.75
Mar. 9,	John U. Ruef	200.00
Apr. 8,	Lanc. Co. Fruit Growers	18.00
Apr. 9,	John U. Ruef	200.00
May 29,	John U. Ruef	200.00
June 16,	John U. Ruef	100.00
Aug. 2,	John U. Ruef	200.00
Oct. 20,	John U. Ruef	100.00
Jan. 3, 1938,	John U. Ruef	200.00
		$1,738.69
	Secretary's account at Bank, receipts	268.72
		$2,007.41

1937	DISBURSEMENTS	
Feb. 2,	Himes Davis Printing Co., Dec. News Letter	$ 110.50
Feb. 24,	Geo. H. Rea, Speakers Expense to Harrisburg	19.50
Mar. 4,	Himes Davis Printing Co., 100 letter heads	7.69
Mar. 17,	Himes Davis Printing Co.	18.88
Mar. 17,	E. A. Bathurst, stenographic work	6.00
Mar. 10,	Martin K. Fry, Printing 200 vouchers	2.00
May 8,	Himes Davis Printing Co., printing proceedings	370.24
June 7,	Martha M. Rockwell, stenographic	112.00
June 7,	Himes Davis Printing Co., 750 envelopes	27.65
June 16,	Himes Davis Printing Co., June News Letter	95.14
Aug. 3,	Martha M. Rockwell, stenographic	28.50
Aug. 3,	Himes Davis Printing Co.	9.95
Sept. 9,	Himes Davis Printing Co.	135.00
Oct. 20,	Himes Davis Printing Co.	13.05
Nov. 16,	Martha M. Rockwell, stenographic	17.25
Dec. 20,	Philipsburg Ledger Co., printing annual program	146.40
Jan. 7, 1938,	Sylvia Meeker, stenographic	9.00
		$1,128.75
	Cash Balance on hand	609.94
		$1,738.69
	Secretary's Expenditures	122.53
	Cash on hand	146.19
		$2,007.41
	University Ave. N. Y. City Apartment Bonds	$ 200.00
	On Saving Account at Bank	638.60
	Cash Balance in Ephrata and State College B.	756.13
	Total Assets	$1,594.73

We have audited the accounts of the State Horticultural Association of Pennsylvania as submitted by the treasurer, Mr. Snyder, and found them to be correct.

(Signed) Auditing Committee.
L. M. Schantz, Chairman.

REPORT OF SPECIAL COMMITTEES

RESOLUTIONS

In as much as death has removed from our midst one of our prominent active members, Mr. Robert Eldon, be it resolved that we express our sincere regret and sympathy. A copy of this resolution is to be sent to the family and incorporated in the minutes.

In view of the certain curtailment of apples in the export trade and in view of the competition of other fruits, due to extensive advertising, be it resolved that this association go on record in favor of:

1. Removal of the poorer varieties and trees that are no longer profitable.
2. A law regulating the sale of inferior grades of apples in the fresh fruit market.
3. The cooperative support of all members in the advertising of Appalachian Apples.

In view of the increasing damage caused to the apple industry by cedar trees growing within an orchard area, be it resolved that this association strongly appeal to the State Department of Agriculture to place the eradication of cedar trees on an area basis similar to that employed in the eradication of tuberculosis in cattle.

Due to burdensome tax on gasoline used exclusively for all farming operations, be it resolved that this association urge the removal of this tax or refund the amounts paid in taxes.

These resolutions were approved.

H. W. Skinner,
Chairman, Resolutions Committee.

LEGISLATIVE COMMITTEE

Your Legislative Committee has no important activity to report for this between sessions year. We have co-operated with other state associations in supporting some and protesting against other federal legislation affecting fruit growers.

At the last session of the State Legislature bills were introduced, supported by your committee and later enacted into laws whereby farmers are exempt from buying licenses for tractors, trucks, or automobiles when operated on public highways between two pieces of land owned or operated by the same farmer. The farmer is required to secure from the Department of Revenue Form T49, answer all the questions fully, and file the paper with the Department. No fee is required. It is pointed out that no vehicle registered under

this act is permitted to perform any errand that would take it off the direct road between the two farms or fields, however short the errand might be, without bearing regular license plates.

C. J. Tyson, Chairman

PACKAGE STANDARDIZATION

President Gillan appointed the following men as members of the Container Standardization Committee, after a lengthy discussion from the floor:

Bentz Kauffman, Chairman; W. E. Grove, H. W. Skinner, Frank Gillan, Henry Baugher, J. Eric Linde, H. F. Hershey.

The committee went into session and recommended that the State Horticultural Association of Pennsylvania adopt a one bushel net box for growers using the count pack, specifications to be drawn up by the National Wood and Box Association and a bushel and a fifth box for the fill and face pack, both boxes to meet the domestic and export specifications, and further recommends that the committee meet with the committees of the three other states, Maryland, Virginia and West Virginia in order to standardize these boxes for the four states.

The recommendation was presented and approved.

FRUIT JUDGING CONTEST

After considerable discussion at the summer meetings, the members of the executive committee favored the discontinuation of the essay contest sponsored by the State Horticultural Association during the past few years and inaugurated a fruit judging contest to be held in connection with the Farm Show at Harrisburg.

The contest was set up to include the placing of three plates each of fifteen standard commercial varieties and the indentification of fifty apples of the fifteen varieties. The contest met with approval in a number of the counties where elimination contests were held. The county horticultural associations appointed a committee to work with the contestants and make arrangements for the trip to Harrisburg.

Five counties entered teams in the judging contest; namely: Adams, Allegheny, Franklin, Indiana and Lehigh.

The final results in the judging contest were as follows:

County	Team	Score	Placing
Allegheny	Wilson Shenot Merle Wasson Clem Ebel, Jr.	7132	First
Adams	Allan H. Tyson Arthur W. Kuntz Wilmer J. Stoner	6612	Second
Franklin	Joseph Hess William Weaver Joseph Rahauser	5999	Third
Lehigh	John Linde Harold Krumanocher LeRoy Lilly	5858	Fourth
Indiana	Lewis Nibert Lawrence Nibert Wayne McHenry	4702	Fifth

Perfect team score—7950

The individual high scores were made by the following contestants:

Wilson Shenot	2422	First
Merle Wasson	2358	Second
Clem Ebel, Jr.	2352	Third
Joseph Hess	2285	Fourth
Wilmer J. Stoner	2230	Fifth

Perfect Score for individual—2650

All contestants are to be congratulated and the association wishes to express its appreciation to the coaches and all members or individuals who assisted in every way possible to stage the fruit judging contest.

TRUE-TO-NAME FRUIT TREE COMMITTEE REPORT

During the summer of 1937 your committee, with the help of Professor H. W. Upshall of The Horticultural Experimental Station, Vineland Station, Ontario, Canada, conducted a nursery tree identification school in Canada. Professor Upshall devoted two days to the Pennsylvania nurserymen, instructing them in tree identification of peach and cherry varieties in the nursery row. Leaf and growth characters of the different varieties make it possible to identify many of them.

The nurserymen attending the 1937 school expressed the opinion that much good is being derived, not only for themselves but also for the fruit growers of the state.

One Pennsylvania nurseryman has studied his sweet cherry varieties so carefully in past years, that he was able to correctly name all but one variety found in the nurseries visited. This one variety he had never seen before.

Your committee expects to conduct a school in the Pennsylvania nurseries during the summer of 1938 to strengthen the work with stone fruits, as well as to review the apple and pear variety study.

F. N. Fagan,
George L. Baugher,
Committee.

THE MANUFACTURE OF FOOD MATERIALS BY THE FOLIAGE OF APPLES AS INFLUENCED BY SPRAYING AND SOME OTHER CONDITIONS

A. J. HEINICKE, Cornell University, Ithaca, N. Y.

As every fruit grower knows, a large leaf surface is needed for the development and maintenance of a good bearing surface and for the production of heavy crops of high quality fruit. The leaf surface is indispensible since it provides the materials used for building shoot and fruit tissues and for furnishing energy for the growth processes. Of course, fertilizer elements such as phosphorus, potassium, nitrogen, and many others are also essential for growth and fruiting, and such nutrients must be applied if lacking in the soil.

The following table indicates the relative amounts of plant food and nutrient required each year by a mature apple tree producing 25 bushels of fruit.

Table 1. Plant Food and Nutrient Required by a Mature Apple Tree Producing 25 bushels of fruit (pounds per year).

Item	Leaves	New Tissue	Fruit	Total
Dry Weight	65.8	197.4	202.5	465.7
Carbohydrate	62.5	187.5	192.4	442.4*
Nitrogen	1.4	1.9	0.6	3.9
Potassium	0.8	1.2	1.5	3.5
Phosphorus	0.1	0.3	0.1	0.5

*An additional 100-125 pounds is used to furnish energy for growth processes.

It will be noted that about 95% of the dry weight is made up of carbohydrates which includes starch, sugars, and related materials. This food is built up in the green leaf tissue with the aid of sunlight from the chemical elements found in water and in air.

If we as fruit growers are interested in the possibilities and limitations of our cultural practices, we must consider the life history of the plants we deal with. It is important that we know something about the activity of the leaf surface especially with respect to the rate of food manufacture under fluctuating natural conditions, as, for example, on clear and on cloudy days, in periods of drouth or excess rain, or with unusually high or low temperatures. We need to know also how the photosynthetic activity of the foliage will be influenced by such orchard factors as soil conditions, fertilizers, spraying, pruning, and thinning.

The structure of the leaf

It might be well to recall at the outset some of the facts about the structure and function of the leaf, with which you are more or less familiar. The leaf consists of a thin green blade supported by a network of veins or ribs which unite to

form a midrib. The leaf is attached to the stem by means of the petiole which is an etension of the midrib, and which contains the tissues thru which water and food materials are conducted.

A cross section of the leaf shows that the interior of the leaf blade is composed mainly of a large number of cells, most of which contain many small bodies. The material in these bodies gives the leaf its characteristic green appearance and is known as chlorophyll, or leaf color. Chlorophyll is responsible for the peculiar power of the leaf to build up carbohydrates from raw materials contained in air and water. The energy for the chemical changes involved is furnished by sunlight and the process is therefore called photosynthesis.

Large cells just beneath the upper surface and at right angles to it are arranged parallel to one another, and they form the palisade layers. The cells just above the lower surface of the leaf are loosely arranged and provide a relatively large amount of air space. The veins and midrib are made up of the conducting tissues which supply the leaf with water and also permit the elaborated food to be removed from the leaf blade of the stem.

The entire leaf is covered by a thin layer of cells which form a kind of skin. On the underside of the leaf there are many openings through this layer. These openings, called stomates are extremely small, and an average leaf may have from ½ to 2 million. As a rule the stomates are closed at night, and they are wide open early in the morning. They seldom remain open all day long, however, and when the weather is hot or dry they may be closed 2 or 3 hours before noon. The adjustment of the size of the opening of the stomates is governed by delicate physical chemical reactions and it is also influenced by the available water supply. When there is a water deficit the stomates tend to close very early. So long as the stomates are wide open water vapor escapes freely, but water is conserved when they are closed.

Since the stomates afford a direct connection between the interior of the leaf and the surrounding air they are of special importance in the process of photosynthesis. Relatively large amounts of air can pass in and out of the leaf even though the stomates are only partly open, but when they are closed tightly, movement of air is inhibited. An abundant supply of air is required for photosynthesis, since it provides the carbon dioxide which is one raw material used in the process.

Determining the leaf activity

By determining the composition of air with respect to carbon dioxide and water before and after it leaves a closed

chamber containing the leaf surface, and if we know how much air has been supplied, we can calculate the rate of photosynthetic activity of the foliage at any hour of the day.

This has been done at Cornell for the past several years for individual leaves and for the foliage of entire trees of bearing age. The following table gives some idea of the amount of carbohydrates produced during different months and at different times of the day.

Table 2. Average Production of Carbohydrates Per Day by a Mature Tree During Different Months and at Different Periods of the Day (In pounds).

1936	Entire Day	4:30 A.M. 9:30 A.M.	9:30 A.M. 2:30 P.M.	2:30 P.M. 7:30 P.M.
June	3.28	0.90	1.52	0.86
July	3.90	1.18	1.94	0.98
Aug.	3.37	0.84	1.73	0.80
Sept.	3.02	0.72	1.64	0.66
Oct.	1.70	0.30	1.10	0.30
Avg.	3.06	0.79	1.55	0.72

The mature tree used in the above calculations contained about 150,000 leaves having an area of 4,183 sq. ft. Since normal air contains only about 3 parts of CO^2 in 10,000, and since the leaf extracts only about 10% of the available supply, something like 500,000 cu. ft. of air are required to furnish the raw material needed for 1 pound of carbohydrate. A gas tank having a capacity of 5,000,000 cu. ft. would hold only enough air for about 10 pounds of carbohydrates, just about one day's supply for a full grown apple tree.

Some factors influencing the rate of photosynthesis

There is considerable difference in the rate at which the foliage from a given tree removes carbon dioxide from the air on different days during the growing season and at different hours of the day. Some of these differences are clearly associated with weather conditions.

As a rule the leaves are most active on bright, clear but cool days, and they are least active when there are heavy.

clouds. Table 2 shows that the photosynthetic activity is much greater on the average from 9:30 A.M. to 2:30 P.M. than in the early morning or afternoon. There is usually much more sunlight during the middle of the day. The following table also indicates how fluctuation in light influences the activity during the middle period on successive days. The expression GrCal is an abbreviation for gram calories per cm^2 for the period and is a measure of light intensity. $GrCO^2$ indicates the amount of carbon dioxide absorbed by the tree in grams. This tree was about 1-12 full size.

Table 3. Assimilation and Light 9:30 A.M.-2:30 P.M. on Successive Days.

Date Sept.	Light GrCal	Assimilation GrCo2	Date Sept.	Light GrCal	Assimilation GrCo2
15	73*	51.5	23	304	99.4
16	325	93.5	24	282	91.3
17	106*	62.0	25	261	82.0
18	276	83.9	26	197	76.7
19	160*	55.6	27	42*	41.0
20	238	83.8	28	34*	36.3
21	81*	49.2	29	85*	65.9
22	208	83.6	30	241	94.7

*Relatively poor light.

During the middle part of a clear day there is more light than the leaf needs, but on a cloudy day there is usually not enough light for the entire foliage of the tree to carry on maximum activity. The occurrence of a number of dull days in succession during a critical period in early summer might well be a determining factor in bringing about internal conditions in the tissues of the tree that would profoundly influence the type of vegetative growth or the initiation of flower buds for next year's crop. The injury from blight or from other diseases or insects may be profoundly influenced also by the condition or status of the tissue of the tree which is so largely determined by the rate of photosynthesis.

Apple leaves are likely to be more active in photosynthesis during the relatively cool days of early spring and late fall than during the very hot days of midsummer. While excessively high temperature in itself may be injurious to the leaf tissue, it probably exerts its greatest influence on the rate of food manufacture through its effect on transpiration. The loss of water from the leaf on cool days is only a small fraction of that lost when it is warm and when the atmosphere shows a high evaporating power. For example, a mature tree lost 108 gallons of water on a clear day at a mean temperature of 85°F; on a cool, clear day the same tree lost 67.4 gallons, and on a partly cloudy day only 25 gallons. Very little water is lost during very cloudy or rainy weather. When the tree loses more than the normal amount of water for a given temperature and light intensity, it usually produces less than the expected amount of carbohydrates for

those conditions. When there is little moisture available in the soil, the leaf tissue is likely to suffer for water, but the shortage of water in the leaf may occur even though there is an abundance of soil water.

High temperatures also greatly increase the rate of respiration which involves a utilization or burning up of some of the carbohydrate material. This loss results in a smaller net gain from photosynthesis on warm days than on cool days. The tree will respire more than twice as much food at 80°F than it does at 50°F. The following data indicate how temperature may reduce the amount of food available for the tree. The temperatures are given in Farenheit and the amount of food manufactured is shown by the grams of carbon dioxide absorbed by the entire tree each hour.

Table 4. Influence of Temperature on Rate of Apparent Photosynthesis.

1936 pair	Temp. °F	GrCo2 Hr. per tree	Light units (GrCalCm2)
1a	74	64.2	347
1b	86	46.0	346
2a	80	74.1	302
2b	96	57.6	358
3a	70	62.4	220
3b	90	50.6	219

Low temperatures in the fall are especially favorable for development of good color and high quality of fruit. With a given amount of light much more food is available for these purposes at low than at high temperatures.

Influence of Fertilizer on Leaf Action

The leaves on different trees and on different parts of the same tree may show a marked difference in their ability to manufacture food. Generally speaking, the darker green leaves are the most efficient in manufacturing food; e. g. an average of 50 determinations with light green foliage indicated a rate of only 4.1 mg. per hr. per 100 cm^2 while the dark green leaves at the same time showed an average rate of 12.1 mg. per hr. per 100 cm^2, approximately 3 times as rapid.

The green color of the leaf, as you know, may be influenced by the nitrogen supply. Where nitrogen application causes the foliage to be darker green it usually brings about a marked increase in the efficiency of the leaves in producing food. This is indicated by data in Table 5. Before nitrogen fertilizer was added to the starved trees A and B growing in sod, they produced about the same amount of food each.

From Aug. 22 to Nov. 3, however, tree A, which received nitrogen on Aug. 4, produced about twice as much food as B which remained as an unfertilized check.

Table 5. Fertilizer added to N. Starved Trees Increases Food Production by Leaves.

Interval 1934	Average rate photosynthesis ($MgCo_2Hr^2 100cm^2$) A*	B*	Total food for mature tree (pounds) A	B
July 24-Aug. 4	10.6	9.8	45.1	41.8
Aug. 22-Sept. 1	12.8	9.9	----	----
Sept. 1-Oct. 10	15.3	8.9	----	----
Oct. 11-Oct. 22	17.7	7.9	----	----
Oct. 22-Nov. 3	7.2	0.0	----	----
Aug. 22-Nov. 3	----	----	270.4	140.3

*Both trees in sod. Nitrogen applied to A on Aug. 4; B remains as check.

Light green foliage may also be caused by soil conditions unfavorable for extensive root development or by injuries to the different parts of the tree. Any cultural condition which results in a dark green color until the end of the season, enables the leaf surface to function to its fullest capacity whenever weather conditions are favorable. Photosynthesis may be carried on until the day before the leaves are frozen if the leaves remain green.

The efficiency of the leaf depends also upon the rate at which the food is utilized by other parts of the tree. If the food is not used for shoot growth or for fruit development, it tends to accumulate in the leaf blade and as a result there is a reduction in the rate of photosynthetic activity. Such an accumulation of food is also caused by ringing. The leaves on ringed branches produce only about 30-50% as much food per given area compared with foliage on normal branches. During the year the tree is bearing a crop of fruit, the foliage produces more food than in an off year. But as shown in Table 1, the fruit may require as much food as all the other permanent parts of the tree. As the leaves grow older they likewise tend to lose their efficiency in manufacturing food.

Spray may influence leaf efficiency

Certain spray practices may have a profound influence on the ability of the leaves to manufacture carbohydrates. Under certain conditions leaves sprayed with lime sulphur may reduce the efficiency of the foliage to a considerable extent. For example, the average rate of photosynthesis before spraying in two lots of comparable trees was 32.8 and 33.0 $MgCO_2Hr100Cm^2$ respectively for A and B. Two days after respectively for A and B. Two days after spraying with lime sulphur 1 to 40, lot A was only 53% as active as the unsprayed lot B. This reduction may occur even though there is no visible burning or injury of any kind. The following table indicates how the foliage of an entire tree reacts to spraying with lime sulphur.

Table 6. Manufacture of Food by Foliage of Baldwin Apple Trees as Influenced by Lime Sulphur Spray.

Period 1937		Percentage of normal rate
July	1- 6	100.0
	7-11	50.9
	12-16	90.5
	17-21	100.7
	22-26	72.0
	27-31	101.0
Aug.	1- 4	102.4

The amount of reduction in the efficiency of the leaves by lime sulphur depends largely upon the condition of the foliage at the time it was sprayed, as well as upon the temperature and water supply to the tree. A weak tree growing on poor soil is particularly susceptible during hot weather and may show as much as 90% reduction. Trees that have dark green foliage may show only 10-25% reduction. Some oils

used for summer spraying may have a similar influence in reducing photosynthesis. Certain sprays such as dry mix and some dusts apparently have no influence on photosynthesis. They are usually not the most effective fungicides or insecticides. No spray material has been found which increased the efficiency of the apple leaves above normal.

Spraying, of course, is necessary because in all likelihood the diseases or insects would cause a much greater loss of food to the tree. Obviously, any injury which eliminates a part of the leaf surface would tend to reduce the total amount of food that could be manufactured. It is important, however, that those who are concerned with the development of our spray practices should keep in mind that while the spray material must be effective in controlling insects and diseases without causing obvious spray injury to the fruit or foliage, it is also necessary that the materials should not interfere with the proper functioning of the leaf. The invisible spray injury may influence the crop by retarding the development of size or the color and quality of the fruit, and in some cases by aggravating the tendency toward alternate bearing.

Conclusion

In this discussion the object has been to call attention to the important function of the leaf in building up carbohydrate food which is fundamental in the growth and fruiting of the tree.

Table 7. Vital Matters in Fruit Production Influenced by Leaf Activity.

Amount of shoot, wood, root growth
(Carbohydrates equal 95% of dry weight)
Increase in leaf surface
Flower bud formation
Set of fruit
Size - color - quality of fruit
Maturity of woody tissues
Resistance to winter injury
Food materials for opening buds

Practically all of our cultural practices may have an influence on the ability of the leaf to provide additional food. It must be recognized, however, that certain weather conditions may have an even greater influence than anything the grower can do in determining the rate of photosynthesis. In general our cultural practices should be such as to favor the development of a large leaf surface early in the season and to keep the foliage supplied with water and nutrients so it can function efficiently in manufacturing carbohydrate food whenever the weather conditions permit.

SOILS IN RELATION TO FRUIT GROWING

JOSEPH OSKAMP, Department of Pomology, New York State College of Agriculture, Ithaca, N. Y.

In our studies of fruit soils in New York during the past 7 or 8 years we are impressed with the variability of the soil within small areas, and by that I mean differences which may exist from tree to tree in an orchard. We feel rather sure that the irregular behavior of individual trees in an orchard is often due in large measure to soil differences.

The survey records show that orchards on good fruit soil often yield twice as many bushels of fruit as those on poor soil. Differences such as these should be highly significant for anyone intending to plant an orchard. It is also significant to the owner of an established orchard for the management can be more effectively directed if soil conditions are known.

It should be made clear that this discussion has to do with the behavior of apple trees under the soil and climatic environment found in New York. The reaction of fruit plants to a particular type of soil will change as the climatic conditions accompanying the particular association changes.

In general we have a satisfactory and rather well distributed rainfall during the growing season. The relative humidity is comparatively high so that water loss thru transpiration and evaporation is not as large as in many sections to the south and west.

The Situation in One Orchard Area

The question is often raised as to how a better knowledge of the soil might affect the fruit area. To illustrate what may be found when we come to classify the soil in an orchard area, I have chosen a block of 13,582 acres in one of our important fruit counties. Table 1 shows that there were somewhat over 3000 acres of orchard in this tract. 57% of the orchards were favorably located, 39% were on marginal soil and 4% on soil unfit for fruit growing. The question naturally comes to your mind, were 43% of the orchards located on marginal and unfit soil because all the good land had been planted? No, there were 5,025 acres of good fruit soil in this area. Fruit growers on these better soils were making some money even during the depression years whereas on the unfavorable soils with lower yields they were fighting a losing battle.

As farmers become more conscious of the importance of soil in fruit growing and as the knowledge of differentiating fruit soils improves, we believe it not impossible to attain a situation where 85% or more of the plantings will be located on favorable soil. The distribution of orchards on different

soil groups will of course vary with the particular area. There are some areas where more than 85% of the orchards are already on favorable soil.

Table 1. Soil and Orchard Distribution in the Hilton Area, Monroe County.

Soil Class	Soil distribution		Occupied by orchard		Orchard Distribution
	Acres	Percent	Acres	Percent	Percent
Favorable	5025	37	1761	35	57
Marginal	6141	45	1217	20	39
Unfit	2416	18	126	5	4
	13,582	100	3,104		100

The Orchard Soil Studies

The fruit soil investigations have been carried on in sample areas in the leading fruit sections of the state. A farm to farm survey was made of the yield and treatment of the orchards by varieties and age. Orchards receiving comparable care were then selected for more detailed studies of tree growth, stand of trees, depth and distribution of root system and character of soil. The soil profile and rooting habits were determined by deep excavations beneath the trees. A very careful description was made of the changes in the texture, structure, color and acidity of the soil with increasing depth and a record was kept of the size, location and distribution of roots in these different soil layers. This proved to be one of the most interesting and valuable parts of the study. Tree roots are very sensitive to soil conditions and depth of rooting is closely correlated with production.

Soil samples were taken of all horizons from the surface downward and various other field and laboratory determinations were made.

Soil Texture Significant

One of the most informing of the determinations made was the mechanical analysis of the horizons of the soil profile. This gives a numerical measure of the texture of the different layers making up the surface, subsoil and deep subsoil. It is a determination of the size of the soil particle and among other things gives a clue to the rate of movement of water thru the soil. The figures given in Table 2 have been arrived at by a short cut method which is sufficiently accurate for our purpose. The coarse and fine sand are listed under combined sand. The coarse silt is listed separately and under total colloids appears all the smaller particles,—fine silt, clay, fine clay, and colloidal material.

After considerable experience one can learn to judge by the feel, the relative amounts of sand, silt and clay in a soil with some accuracy. A high portion of sand or a low content

of colloids in a soil means that water is going to percolate thru it rather rapidly, while a high proportion of colloidal material gives a soil thru which water moves very slowly.

In table 2 the total colloids and acidity expressed as pH are given for 3 profiles which represent important soil groups. The acidity is included here because in this case where the parent material from which the soil was formed is calcareous it does have a relation to texture and drainage conditions. The first profile,—a sandy soil with only 11% colloids in the surface soil, and half that at lower depths, allows a very rapid penetration of water. This free drainage has served to leach out the carbonates in the soil, which have been carried away in the drainage waters, leaving the soil rather acid.

The pore spaces between the soil particles are occupied either by water or air. As water moves thru this soil rapidly it is displaced by air and hence such a soil is often spoken of as being well aerated. This has an influence on its color. The oxygen of the air combines with the iron compounds in

Table 2. Texture and Reaction of Typical Soil Profiles.

Soil Horizon	Depth in.	Combined Sand	Coarse Silt	Total Colloids	pH
A	0-9	77	12	11	5.30
B	9-30	84	7	9	5.88
C	30-84	88	6	2	5.25
A 1	0-10	28	41	31	5.81
A 2	10-24	32	40	28	5.75
B 1	24-36	27	48	25	6.66
B 2	36-60	15	43	42	8.29
C	60-72	9	12	79	8.12
A 1	0-9	28	29	43	6.20
A 2	9-13	32	38	30	5.40
B	13-24	20	28	52	5.45
C	24-56	6	9	85	8.05

the soil imparting a brown color much as metallic iron takes on a brown color from rust when exposed to the air. A characteristic of such a soil profile therefore is a rather uniform brown color of all the horizons. Trees root 6-8-10 feet deep or deeper on such soils. The roots are rather smooth surfaced and are a bright shade of brown. Trees are large for their age and productive, with few vacancies in the orchard.

It is possible, however, to have a deep sandy soil that is water-logged, because of an obstruction of impervious material which dams up the water over a clay substratum which may be several feet from the surface. The effect of this water-logging is to exclude the air from the soil so that there will be grayish horizons where little aeration has existed and other parts of the profile will be highly mottled gray and brown due to uneven oxidation. Trees root 2-3 feet deep de-

pending upon the seriousness of the water-logging. The roots are inclined to be rougher of surface and much darker in color than on well drained soil. Trees are small for their age, low in yield and vacancies are numerous.

In a sandy soil or even one of loam texture the color of the profile is an excellent guide to drainage conditions.

Let us look at the second or silt loam profile shown in Table 2. Here is a soil of medium, rather uniform texture in the first 3 feet. At the depth of 3 to 5 feet, however, the soil becomes considerably heavier and below 5 feet the total colloids rise to 79%. This soil is moderately permeable in the surface 3 feet, which provides sufficient volume to absorb the usual rainfall without water-logging. It will be observed that where the B 2 clay layer comes in at a depth of 3 feet drainage is slowed up and the pH is 8.29, which indicates free carbonates. This is a good fruit soil where the topography is gently rolling so that surface drainage is fairly rapid.

The third profile shown in table 2, unlike the soil above where a heavy clay horizon C comes in at 5 feet, has a heavy clay layer C at a depth of 2 feet. It will be noted that this horizon is calcareous and free carbonates at this depth (2 feet) are characteristic of slowly drained heavy soils where the parent material is calcareous. The topography is usually nearly level to undulating so that surface drainage as well as internal drainage is slow.

The gray layer and mottling are not always well developed in heavy textured soils as changes occur rather slowly in them. The level topography, the proximity of heavy clay to the surface, and in certain soils the presence of free carbonates at a shallow depth are all valuable guides in spotting this kind of condition.

Ground Water Measurements

An excellent way to determine the drainage conditions in any field is by means of ground water measurements. Such records can be obtained from test wells 4 feet deep made with an ordinary soil auger. They should be distributed over the proposed site so as to include the varying conditions of elevation and soil texture. Four test wells per acre are more accurate than a lesser number. The observations are best made during April and May and at frequent intervals before and after rains. The distance from the soil surface to the free water surface is measured with an ordinary carpenter's rule. Ground water ordinarily disappears by July as evaporation increases at the higher temperatures and as vegetation becomes vigorous and draws on the soil moisture.

If ground water persists within a foot or two of the surface during the critical blossoming and fruit setting period, the normal functioning of the roots is interfered with and the tree suffers accordingly.

Unless the records cover a season normal or above in precipitation they may not have full significance. For this reason two season's results are desirable and hence time and patience are required. Well drained soils contain almost no ground water in the surface four feet; in those imperfectly drained, ground water will be found at about the 2-foot level for a month or more in May or June; while the poorest drained soils will be water-logged within a foot of the surface.

Artificial Drainage

The most frequent barriers to good drainage observed in our State is a relatively level surface and a heavy clay subsoil. Such areas can be avoided when new plantings are made, but there is a considerable number of existing orchards in such areas. Will tile draining solve the problem? The data available on this point are meagre. Fortunately we have an excellent comparison at Cornell with the McIntosh variety. The soil has been mapped as the Dunkirk silty clay loam in the soil survey of Tompkins County. An area, however, which includes about half the orchard is relatively level and underlaid at a depth of about 18 inches by a heavy clay subsoil. The rest of the orchard is the true Dunkirk silty clay loam having a rolling topography and a silty clay profile of relatively uniform color and texture.

Table 3. Artificial Versus Natural Drainage
20-year-old McIntosh Orchard

Drainage	3 in. tile 2 feet deep, 40 ft. apart	No tile Natural drainage
Topography	1% slope	5% slope
Soil	Clay loam	Silt loam
Subsoil	Heavy clay	Silty clay
Depth to ground water 2 weeks before bloom	12 inches	18 inches
Average yield of 18 trees during a 12 year period	6.9 bushels	10.4 bushels

When this orchard was planted several years ago, the heavy portion was tile drained every 40 feet between each row of permanent trees. These were 3-inch tile laid about 24 inches deep. In Table 3 is given the average yield of the tres in these two portions of the orchard. It will be seen that the trees on the soil without artificial drainage, which was naturally fairly well drained, produced on an average from their 9th to 20th year 50 per cent more fruit than those trees where the heavier soil was tile drained. Both of these lots of trees were in the same orchard with the same treat-

ment except that the trees where the tile were installed had a heavy application of barnyard manure the last 10 or 12 years which the other trees did not receive. How much worse these trees would have been without the tile and manure we cannot say.

The difficulty was that the tile drains in this case which were laid in accordance with what is commonly considered good agricultural drainage practice, were not functioning in this heavy soil sufficiently rapidly to lower the ground water to the extent that prevailed in the naturally better drained soil, without artificial drainage. The average of the ground water readings is indicated in Table 3. I think we can say pretty definitely that under such conditions as these, drainage as ordinarily practiced is not satisfactory for orchards. Draining wet spots in otherwise good orchard land, however, is practical, as is the drainage of certain sandy soils thru which water moves freely.

It is interesting to note that the Baldwin trees on this heavy soil have been dying rapidly during the last 10 years, while only one McIntosh tree is partially dead. From what I know of Grimes and Stayman, I would guess that they might react much the same as Baldwin to a wet soil.

Structure of the Subsoil Important

There is a class of soils derived from glacial till deposits which have been largely uninfluenced by any other natural forces except weathering. Another large group of soils have been the result of reworking these glacial soils by glacial stream or lake waters and redepositing them in the form of water sorted material. The water sorted soils contain mostly rounded gravel and stone and are usually several feet deep, while the glacial till soils are characterized by sharp angular stone and gravel and are often underlaid at a depth of 2 or 3 feet by a subsoil very compact in structure, which tree roots scarcely penetrate. This results in shallow rooting and low yields. Sampling with a soil auger will not reveal the true nature of this material as it bores up loose and friable on the auger. It is necessary either to make an excavation or use a soil tube.

Obviously the presence of shale or bed rock at depth of 2 or 3 feet limits root penetration. Some soils are characterized by such shallow areas of small extent which are difficult to map out in a soil survey. Where the soil is shallow, trees will be small, fruit often undersized in dry years, in contrast to adjacent trees on deeper soil, of large size and with excellent production.

What Constitutes a Good Fruit Soil

We have been considering some of the things which definitely limit the usefulness of a soil for fruit purposes. Table 4

summarizes the effect on yield of these different soil conditions in one of our orchard areas in western New York. The figures are for Baldwin orchards averaging about 50 years old. It is the older trees with their greater need for root penetration and expansion that are most susceptible to the soil environment.

A good fruit soil should be deep, that is it should be composed of sufficiently permeable soil material that water and tree roots can find their way thru it to a depth of at least 4 feet. The best fruit soils afford a congenial medium for rooting to a depth of 8 feet or more. Such soils are relatively uniform in structure, texture and color thruout the profile. The color is usually some shade of brown and fairly uniform in the surface two feet or deeper. A slight amount of mottling or irregularity in color is characteristic of certain types of good fruit soils, but highly mottled soils are seldom satisfactory.

This matter of depth is more important than either fertility or moisture holding capacity of the upper layers, under the climatic conditions prevailing in New York State. Some of our best fruit soils are considered infertile and droughty for farm crops, but the tree roots are able to occupy such a large mass of soil and contact such a moist substratum at lower depths, that excellent results are obtained.

Table 4. Average Annual Yield of Old Baldwin Trees on Different Soils in Wayne County, New York.

Soils	Average annual yield Bushels
Deep, sandy, gravelly loam, well drained	10.6
Deep silt loam, well drained	9.5
Silty clay loam, imperfectly drained	5.5
Sandy loam, imperfectly drained	4.9
Glacial till loam, no compaction	9.5
Glacial till loam, very compact subsoil	3.7
Glacial till loam, shale or bed rock at 3 feet	3.6

The Soil Profile and Soil Moisture

Soil moisture is so important that it seems worth while to consider these soil conditions, typified by the profiles we have been discussing, from the angle of soil moisture relationships.

One of the most important single factors in determining a suitable soil moisture supply in the orchard is the character of the soil itself. With the rainfall and climatic conditions commonly found in New York, most any system of orchard soil management will give satisfactory moisture control on a good fruit soil. A good fruit soil is more a question of physical condition of the soil than of the chemical constituents which make up the soil. Good depth, drainage and aeration are primary requisites, even though the soil may be low in fertility. Fertility can be supplied but it is well

nigh impossible to materially alter the physical condition of the lower subsoil and it is in the region of the subsoil that unfavorable conditions are met. It is these conditions that affect the depth of rooting and the depth of rooting is closely associated with the moisture supply available to the tree.

Shallow rooted trees often have their roots confined to the surface 2 or 3 feet, because of a water logged soil, a very compact hardpan development or the presence of bed rock. Where the roots of a mature apple tree are confined to such a limited space it takes only a short time for them to exhaust the soil moisture in such a restricted mass of soil and the trees are sure to suffer for moisture any week in the summer when at least an inch of rain does fall. Although we consider the rainfall pretty well distributed in our State, we know that a regular supply of an inch a week cannot be counted on. Hence shallow rooted trees are almost sure to suffer for needed soil moisture most every year, with a corresponding reduction in size of tree, size of crop and size of fruit.

These points are well illustrated in Table 5 which represents a young McIntosh orchard, part of which is on a favorable fruit soil of glacial till origin where the trees are rooting 4 feet deep and in another portion of the orchard bed rock restricts the depth of rooting to 2 feet. This affords an excellent opportunity to study soil moisture and tree behavior under these two contrasting set of conditions in the same orchard where the trees are receiving the same care. While these conditions may seem extreme the shallow rooting is the significant thing and essentially the same results would be obtained whether the shallow rooting were due to waterlogging in the spring or to the very compact structure of the subsoil.

Table 5. Soil Moisture on Shallow and Deep Phases of a Gravelly Loam Soil of Glacial Till Origin.

Date 1936	Rain inches	Soil Moisture Per cent: Shallow soil 0-24 in.	Deep Soil 0-24 in.	Deep Soil 24-48 in.	Fruit Volume c. c.: Shallow Soil	Fruit Volume c. c.: Deep soil
May 5	----	26.7	28.9	21.7	----	----
June 16	4.8	19.6	25.9	19.8	17	16
June 30	1.1	13.7	20.0	16.2	37	38
July 13	0.2	8.4	12.2	10.8	51	62
July 27	4.3	18.4	25.1	18.2	73	88
Aug. 25	3.6	18.3	21.5	13.6	143	161
W.P.*	8.4	7.9	7.9			

Depth of rooting shallow soil 24 in.—deep soil 48 in.
Average trunk girth shallow soil 29 in.—deep soil 42 in.
Average yield shallow soil 5.2 bu.—deep soil 10.4 bu.

*W.P.—wilting percentage, or the point at which the tree is unable to draw more moisture from the soil and wilting ensues.

Several fruits were tagged on each tree and their growth measured at frequent intervals. The fruits on trees on both

shallow and deep soils grew normally during the period of ample rainfall up until June 30. Then there came a period of 2 weeks, when only a trace of rain fell and the moisture in the soil was drawn down to 8.4 per cent or the same as the wilting percentage given in the bottom line of the table. At this moisture content the trees were suffering, for the wilting percentage is the point at which the tree is unable to obtain more moisture from the soil and wilting ensues. At this same time trees on the deep soil were well supplied with moisture thruout the 4 foot section, as the soil moisture was well above the wilting percentage.

The effect of this two weeks of dry weather was to slow up the fruit growth on the shallow soil and altho rains occurred later, the best that the fruit could do was to resume its normal rate of growth—it never made up what had been lost and at picking time was distinctly smaller than the fruit from trees in the same orchard on the deep soil. This effect of stunting the growth of fruit is characteristic,—the loss in size is a permanent loss. The size of the trees and the yield were also reduced as given at the bottom of the table.

Where fruit trees are rooting deeply: 6, 8, 10 feet or more, the volume of soil from which water can be drawn is enormously increased and even tho the soil may have less water-holding capacity than a shallower soil, it may not be pulled down to the critical point. This is well shown in Table 6, where after two weeks without rain the soil is still above the wilting percentage at all depths. Moreover in this soil there is a moist strata below 6 feet which fluctuates little in moisture content thruout the summer.

Table 6. Soil Moisture on Deep Sandy Loam Soil of Lacustrine Origin.

Date	Rain	Soil Moisture Percent					
1936	Inches	0-12 in.	12-24 in.	24-36 in.	36-48 in.	48-72 in.	72-96 in.
July 6	2.17	5.7	7.1	6.6	6.6	13.5	21.1
July 19	0.0	5.3	6.0	6.0	6.1	10.2	20.1
Aug. 19	1.32	5.9	6.5	5.6	5.4	7.1	20.1
W.P.*		4.9	4.0	2.8	2.5	2.6	2.7

Average depth of rooting Old Baldwin Trees 87 in.

Average annual yield Old Baldwin Trees 12.3 bu.

*W.P.—Wilting percentage or the point at which the tree is unable to draw more moisture from the soil and wilting ensues.

We know from experiments that in such a case even tho the soil above were dried out, the roots contacting the moisture at 6 feet would keep the tree supplied with moisture. Of course in sections where droughts are a probability and particularly if they last thru two seasons and dry up the subterranean supplies of water, particular conditions like this might be rare, but the effects of deep rooting would still be very important.

PROBLEMS CONFRONTING PEACH GROWERS

F. P. CULLINAN, Senior Pomologist, U. S. Bureau of Plant Industry, Washington, D. C.

Records of total peach production for the United States show that Pennsylvania ranks among the leading peach growing states of the country. In the season just past, this State not only produced its second largest commercial crop, but, according to estimates, it was first in total production among the freestone peach states outside of California. This position was made possible because of the relatively light crop in Georgia, where a mild winter and early spring frosts reduced the crop. In the past ten years there has been fairly regular annual production in your State. In discussing the subject of problems confronting growers, I take it that methods of increasing yields are not of greatest importance or concern to you. While there has been some reduction in the number of trees here, as in other states, there is also some replanting. Much of the acreage set to new varieties is to replace orchards which have gone out on account of age and injury following cold winters of more recent years. In addition, of course, there is some new planting. When growers are replanting there is always interest in new varieties, both from a commercial standpoint for shipment to distant markets, and also for more local home use or nearby markets. While there have been quite a large number of new varieties introduced during the past five years, not many of them have yet gone through test winters to determine their hardiness, and thus their commercial possibilities. Hence it is not so easy to answer the question frequently put to us—If you were planting an orchard today, what varieties would you plant?

Among the older varieties, there is no outstanding commercial freestone coming in ahead of Golden Jubilee. A few varieties introduced in recent years look very promising at this time, but they will require further testing. It is true that some of the New Jersey varieties, such as Marigold and Sunbeam, have a place in special localities where local market conditions may be a factor. In addition, early ripening sorts, such as Mayflower, Early Wheeler, Mikado, and Greensboro, are planted to suit similar conditions. The Golden Jubilee is one of the best early Freestones, and where it can be well grown it is of good quality and size. Under some conditions it tends to soften along the suture and does not make a satisfactory variety for long distance shipment.

During recent years, a number of varieties of promise coming in after Golden Jubilee and ripening up to the Elberta season have attracted attention. These are, in order of ripening at our station during the past season, Golden Globe, Maxine, Eclipse, Golden East, Vedette, Halehaven,

July Elberta, Valient, and Veteran. The last variety ripens about a week ahead of Elberta. Of this list at this time the Halehaven appears to be one of the most promising introductions. It may not prove to be any hardier in bud, if as hardy, as South Haven, but because of its firmness of flesh, good color, and desirable shipping qualities it will doubtless replace the South Haven variety. The Canadian variety Vedette, which ripens at about the same season as Halehaven, is also of high quality. Under our conditions it is not quite so highly colored. The Valiant has shown up as a very promising variety with us, while the Veteran, of about the same size, is a little hardier in bud. The latter variety has the objection that the flesh in some seasons is inclined to cling slightly to the stone. These varieties ripening after Golden Jubilee are all yellow-fleshed varieties. White-fleshed varities of good quality are the Cumberland, ripening just ahead of, or with, Golden Jubilee, Belle of Georgia, an old variety ripening just ahead of Elberta, and White Hale, a firm-fleshed variety ripening near the close of the Elberta season. Elberta is still the important midseason commercial variety for this State. It may be that before long, as the result of breeding investigations, a variety superior to Elberta will be found. So far, however, considering all of its commercial attributes, we do not have a variety of its season to take its place. I do not suppose that many of the growers here are interested in peach varieties ripening after Elberta. Brackett, coming very close after Elberta, and Salberta, a few weeks later, have been grown to a limited extent. It is quite impossible in a discussion of varieties to go into the merits of many others which have been found more or less satisfactory for special conditions. I have tried very briefly to cover those in which growers might be interested for new commercial plantings.

I should now like to consider some of the factors affecting growth and size and quality of fruit. This discussion will deal not so much with methods of increasing yield per tree as with obtaining better size and quality of trees now established.

Fertilizers and Tree Vigor

In nearly all peach-growing sections of the eastern United States peach trees will not make satisfactory growth unless there are fairly liberal supplies of available nitrogen in the soil. In years past this nitrogen has been obtained by growing peach trees principally through cultivation of the soil. This continual stirring of the soil, resulting in the breakdown of the organic matter and the release of soluble nutrients, has supplied the nitrogen requirements of the trees. In most of our soils, however, sufficient nitrogen for the best tree growth cannot be obtained through cultivation alone,

Growers have also supplied the nitrogen requirements of peach trees with applications of barnyard manure. Under such a treatment peach trees do very well, but this source of nitrogen is no longer available in sufficient quantities and the peach grower must rely upon annual applications of some of the inorganic sources such as nitrate of soda, sulfate of ammonia, or cyanamid. There has been considerable experimentation to determine the proper amounts and time of application for the most efficient use of these materials. I assume that in this state a large amount of the nitrogen used in one or more of these nitrogen fertilizers is applied in the spring. The certainty of annual crops cannot be predicted with the peach to as great an extent as with the apple. It may be good economy, therefore, to wait and see how the buds survive the winter temperature. We know that when nitrogen is applied to peach trees in the fall some of it is taken into the roots and stored there. In early spring an increase in nitrogen content can be determined in the new twigs. In some of our experimental studies we have also found that the nitrogen is taken up readily in the peach any time during the growing season. This is especially noticeable where nitrogen is applied to starved trees and where the color change in the foliage may be observed within a week's time after the application. When nitrogen from inorganic sources was first used on peaches there was much speculation as to its effect on the color of fruit. Observations were reported that nitrogen decreased color and that too much nitrogen produced peaches of poor quality. There has been considerable experimental evidence in recent years to show that applications of a readily available form of nitrogen, if applied while trees are in bloom, or even three to four weeks later, will not seriously affect color of the fruit. On the contrary, in order to obtain satisfactory terminal growth and to produce vigorous leaves, which are so essential in producing color of fruit, nitrogen is needed. As will be pointed out later, heavy applications of nitrogen, with severe pruning, may result in a heavy vegetative growth and result in poor color, largely through the shading effect of the foliage. An adequate, healthy leaf surface on a peach tree is one of the most necessary requisites for good color.

While nitrogen is the element in fertilizer resulting in greatest growth, and the one most frequently required by peach trees, there are some soil areas on which peach trees have shown a response to potassium. These areas are found largely in the soils of coastal plain regions. At the present time these areas are not very widespread, but some peach orchards in these areas have been benefited by applications of potassium nitrate or other fertilizers containing potash salts.

To date, fertilizers containing phosphorus have not shown

any marked benefit on peach trees. Its use in connection with the fertilization of cover crops, or other crops grown on the land, has evidently been sufficient to supply the needs of the tree.

Soil Management

Most of the commercial peach orchards are grown under some system of cultivation. During the past few years there has been an increase in the amount of cover crops used and a reduction in the number of summer cultivations. The question is frequently asked, can peaches be grown in some system of grass culture? Past experience seems to have indicated that peach trees have not done so well in permanent sod as apple trees. This is probably due to the fact that the peach requires a large amount of available nitrogen for best growth and also a fairly constant supply of moisture. Most of our peach orchards are not located on sites with deep soils which provide a good reservoir for soil moisture.

During the past five years we have been carrying on some studies to determine the amount of cultivation necessary for the best growth and development of peach trees. We hope from these studies to be able to develop proper soil management practices for the peach. We are interested in knowing we can satisfactorily grow a young peach orchard with a minimum amount of cultivation. We have had in mind two things; 1, the increase in the fertility of the soil through the use of cover crops and the resulting nutrients made available through the breakdown of these cover crops, together with their effect in maintaining the organic matter content of the soil, and, 2, the effect of these cover crops on moisture and nitrates as they affect growth and production of the trees.

We have two orchards in these experiments, one located on a sassafras gravelly loam soil, and the other on a sandy loam soil. The trees in both orchards are now six years of age and have been in differential cover treatments for the past five years. In these experiments we have used a double cover crop system consisting of summer covers of soybeans, buckwheat, crotalaria, and weed growth, followed by a winter cover of rye and vetch. In addition, single annual covers of lespedeza and sweet clover have been grown, while other plots have been maintained with no summer cover but a winter cover of rye and vetch.

In the lespedeza plot only one discing has been given, and that one in the late winter to disc the dry residue into the soil to facilitate reseeding. The sweet clover has been maintained as a biennial, being clipped once the first summer, and once or twice in the second summer, allowing it to reseed in the second year. It has usually been disced in July or Aug-

ust of the second year and reseeded. In the five years of this experiment there have been two crops of biennial sweet clover.

The rye and vetch cover was disced under in mid to late April, which in the latitude of Beltsville, Md., is about at the time the trees are in bloom. One or two discings were then given between April and June 1, when the summer covers were seeded. These summer covers are disced up in late August, or after harvest, and are followed with a seeding of rye and vetch for the winter cover. At the time of seeding the summer and winter cover crops 250 pounds per acre of a 5-8-5 fertilizer were drilled in with the seed. A similar amount was drilled in the plots of sweet clover and lespedeza early in the spring. This fertilizer was applied primarily for the growth of the cover crop, while the trees received what was considered to be an adequate application of nitrogen, consisting of a half pound of nitrate of soda in the first year, and increased to three and one-half pounds in the sixth year, broadcast around the tree under the spread of the branches.

The best growth to date on the six-year-old trees has been made on the plots receiving only a winter cover of rye and vetch. The trees receiving summer covers, particularly soybeans, have made satisfactory growth, but the trees are somewhat smaller.

In the five years of this experiment there have been three years in which we had protracted periods of dry weather during the growing season. Moisture samples taken during the season showed that the cover crops reduced the moisture in the soil under the lespedeza and sweet clover to a lower point than under cultivation or some of the summer covers. In 1936 we had little summer rainfall. The moisture in the first two feet of soil in the lespedeza plot was reduced both by the trees and the cover crop to the wilting percentage for a four weeks period in late June and July, and again in August for a three weeks period from August 1 toAugust 21. This last period was the time of final fruit swelling. Under a heavy growth of sweet clover the moisture was reduced more than under lespedeza. After cutting the sweet clover and discing it up in early August in 1936, the soil moisture remained above that of the lespedeza plot for the remainder of the dry period, in contrast with the lespedeza and legume sod plots. The soil moisture under cultivation alone or under soybeans did not reach the wilting percentage until mid August, when with continuing drought trees and cover crops began to wilt. It appears, therefore, that on these plots in which the soil moisture was allowed to accumulate as a reserve early in the season, before the cover was seeded, it was not reduced to the wilting percentage until much later than that under lespedeza and sweet clover.

It is true, of course, that the growing peach trees will re-

quire nutrients as well as moisture, and it is quite likely that a cover crop competing with the tree will also deprive it of some of the available nitrogen. This nitrogen is only temporarily tied up, because it will be released to the tree when the cover crop is disced under and decays in the soil. Nitrate determinations made on these plots, however, indicated that the differences in moisture content were very much greater than differences in the nitrate content.

We recognize that there are sites on which it may be necessary to maintain more or less of a permanent cover, or at least some growth of grass or weeds, where erosion is a problem. Certainly it would not be a good orchard practice to continue summer cultivation on a soil type and site which was very subject to erosion. It may be better to keep the orchard in some grass cover, even at the risk of reduced growth, than to sacrifice a considerable amount of top soil to erosion forces. In this state I assume that there are years in which your summer rainfall will supply ample moisture for the needs of the growing cover crop and the tree. In dry periods the cover crop may be mowed to reduce to a minimum this competition with the trees for moisture. These experiments on which I have just reported have also shown another very interesting thing. The buffer row, that is, the row next to a cultivated plot, has been benefited by the cultivation received on one side. This suggests the possibility of alternating middles of sweet clover or some grass cover with some summer cover where the soil is stirred more frequently. By this alternation of sod or grass and cultivation it should be possible to obtain fairly satisfactory growth of the tree.

I think we can be quite safe in saying that it is not necessary to cultivate the peach orchard as frequently as has been done in the past in some of our important peach-growing sections. There are certain definite advantages in the use of cover crops in the peach orchard. Where soils are not of sufficient depth to store large quantities of water in winter and early spring, and thus are not able to support the growth of the tree and cover crops during the summer months, certainly a winter cover should be used, not only for its beneficial effect in preventing erosion, but also for its nutritional value to the trees when disced under each spring. The cover crop also serves a very important function in utilizing mineral elements, particularly nitrate nitrogen, and thus reduces the leaching of these materials from the soil in winter. It is a conservation process, since these materials are made available to the tree upon decay of the plants. Experimental evidence indicates that we probably cannot expect to increase the organic matter content of the soil, but if by soil management practices we are able to maintain the level of organic

matter originally present in the soil, or prevent its too rapid destruction and loss, the use of cover crops will be quite well worth while.

In the experiments reported here we have been able to grow a young peach orchard during the first six years of its age with quite satisfactory results under a system of double cover-cropping. Cultivation has been reduced to a minimum and soil erosion on fairly steep slopes has been prevented. In this connection, I should like to point out another very important use of cover-cropping in addition to its nutritional value. That is its aid in facilitating water penetration and preventing run-off.

The Old Peach Orchard

The problem in the old peach orchard is somewhat different from that in the young orchard. If considerable top soil has been lost by years of cultivation, it may be rather difficult to obtain a good stand of a cover crop. Whatever the cover crop used, it should be seeded in time to obtain a fairly good top growth before being checked by cold weather. Fertilization of the cover crop to obtain a good growth is quite important. The same fertilizer practice that has been found necessary to obtain the best growth of the cover used when grown outside the orchard should likewise be used to obtain the best growth of this cover when used in the orchard. A good growth of cover has been obtained in old peach orchards where a fertilizer high in nitrogen and phosphorous has been used at the time of seeding. If erosion has been rather severe in an old peach orchard the use of mulching material brought into the orchard might well be considered as a means of preventing further erosion and thus aid in moisture conservation through the effect of the mulch.

Much has been said about the effect of these cover crops on moisture. It has already been pointed out that moisture is one of the important factors affecting the size and quality of peaches. From what has already been said about the importance of moisture during the period of final swell, it must be apparent that the orchard practice that is followed in the peach orchard should be one to conserve moisture during the period when peaches are making the most rapid growth.

It is not uncommon in the years of a heavy peach crop to hear growers make the statement that they could have made 10 to 15 cents a bushel more on their peaches if the size and color had been better. In some years it is not entirely the grower's fault that the fruits are not larger. He may have thinned the fruit, fertilized the trees, and performed all the other orchard practices to the best of his knowledge, but lack of rainfall was the principal cause of smaller fruit. There are some factors that are outside of the grower's control. There are other things that he can do to help improve size

and quality when weather conditions are favorable. These are some of the factors that I should now like to discuss with you.

Growth Rate of Fruit

If we measure the growth rate of the peach fruit we find that there are three definite stages in its development. From the time of blossoming, for a period of approximately 60 days for Elberta the young developing fruit grows very rapidly, principally in length and suture diameter. Then there is a period when the peach begins to slow down in growth, which is usually spoken of as the pit-hardening stage, because, if we cut into the peach, we find that the inner flesh which later becomes the pit, begins to harden. During this period, while growth is slow, there is some increase in size. Finally, a third stage is reached in which the peach increases markedly in cheek diameter. This is the period that is commonly spoken of as the final swell. From the grower's standpoint this seems to be the most important period, since all of the cultural operations which have been done up to this time will determine the degree of final swell. This is the period in which a critical moisture shortage may result in a large monetary loss to the grower if the peaches do not reach proper commercial size.

As the peaches increase in size or volume during these various growth phases, the ultimate size will in large part be determined by the number of fruits carried on the tree. Under conditions favoring abundant blossoming and a heavy set, volume increase during the first growth stage may not be so great as where the set is lighter. A heavy set of fruit on a peach tree constitutes a considerable drain on the nutrients; hence, if too many fruits are allowed to develop, there may not be sufficient nutrients to take care of the growth of all the fruits and at the same time provide for adequate shoot growth and the production of leaves; consequently, near the end of the first growth period we frequently notice a heavy shedding of fruits in what is commonly spoken of as the June drop. On fairly vigorous trees there usually are too many fruits remaining on the tree after the June drop. It is apparent under these conditions that even with a fairly liberal supply of nitrogen and good soil cultural conditions, including ample moisture, peaches will not make desirable commercial size. Under conditions favoring a heavy load of fruit, the leaf area is usually inadequate, to manufacture food materials necessary for the best enlargement of all of the fruits.

Leaf Area and Size of Fruit

The relationship of leaf area to size and quality of fruit is one of the important factors, therefore, to be considered.

We know from our experiments, in which the number of leaves on the peach tree are adjusted to the number of fruits produced on the branch, that those fruits on branches with a larger leaf area will be of better size and better color at the end of the season. In the experiments where we have ringed branches of peach trees, thus allowing all of the food manufactured by the leaves on the ringed branch to be utilized in the growth of the peaches on that branch, we have found that peaches grown with a leaf area of 10 leaves per fruit are not as large as those grown with 30 leaves per fruit. A 10-leaf ratio would correspond with that of a heavily loaded, or possibly an unthinned, Elberta peach tree. Not only is the size of the fruit smaller on those limbs with a small leaf area, but the quality (that is, the flavor, juiciness and texture) is not so good as that of the peaches on branches with a larger leaf area.

In this matter of thinning the question of time logically comes up. Is it better to do the thinning earlier in the season and remove the large number of fruits that normally would develop, and thus allow the energies of the tree to be diverted into the production of shoots and leaves, or should the grower delay the time of thinning until he can be assured of the number that will eventually set? We have been carrying on some experiments during the past few years to study the effects of early thinning on increase in size of fruit, leaf, and shoot development and fruit bud formation. These studies indicate that on the early-ripening varieties reduction in the number of fruits before the June drop has greatly increased the size of the fruits at the end of the first swell. Not only has this early thinning had an effect on the size of the fruit but there has been an increase in shoot growth and leaf size resulting from this early thinning. It is questionable, however, whether the benefit derived in a single season from this increased fruit size will compensate for the cost of removing a large number of fruits that would fall in the June drop. The June drop is very largely prevented by early thinning. With many of the early-ripening varieties, however, this early thinning may prove economically worth while. With later ripening varieties, it is usually the practice to wait until after the June drop and then to remove many of the small-sized and imperfect fruits. As will be noted from the slow increase in size during the second growth phase, thinning may be done any time during that period without affecting the growth rate during the pit-hardening stage. Experiments have shown that if thinning is delayed until the period of the second growth stage, it may be done any time during this period, and still give the same beneficial effect on final size over fruit on non-thinned trees.

It should be recognized that in the last analysis the number of peaches to remove from a tree will depend upon the

size of the tree and its bearing capacity. If the tree has the bearing capacity of only one to two bushels only the number of peaches that will develop into 2¼ or 2½ inch size should be left to make up this amount of fruit. When the tree sets uniformly heavy, it is possible to thin to a distance of 6 to 8 or 8 to 10 inches. In most cases, however, this cannot be done satisfactorily, so that the leaf area and bearing capacity of the tree should be taken into consideration. It might be that following a freeze all of the live blossom buds are found at the base of terminal shoots. In this case it may be necessary to leave all of these fruits, even though only an inch or two apart, or even touching, if the leaf area is sufficient to take care of this set.

To come back now to the effect of leaf surface, which we were discussing, we find that if the fruits have not been properly thinned, and if the tree is carrying too heavy a load, the final swell will not be sufficient to produce large peaches. The fruits will not only be smaller but will also be of poor color. If the trees have been grown in grass and dry weather occurred during this period of final swell, or if the organic matter content of the soil is low, and the moisture-holding capacity of the soil is also low, there may not be sufficient moisture to take care of the developing fruit. This brings up the question of what the grower may do in the way of soil management practice, which has already been discussed, to provide conditions favorable for the development of size and quality in fruit.

Finally, in considering the factors affecting quality in peaches, we cannot omit the variety from consideration. At the present time the Elberta variety is the most important freestone variety grown commercially in this county. While this variety has been severely condemned because of its poor quality, there are certain years, at least, when its quality could be much improved by the proper cultural practices. An Elberta peach that is grown on heavily loaded trees and picked prematurely for shipping is not a very desirable market product. On the contrary, however, there are many thousands of bushels of Elberta shipped which are of fairly high quality for this variety. Some of the newer varieties ripening ahead of Elberta are of intrinsically higher quality. Such varieties as Golden Jubilee, Haleshaven, Vedette, and Valiant, would be listed in that class. Those of you who have good roadside markets, or have an outlet in cities close by where the haul to market is not too great, might well consider the desirability of supplying the public with higher quality fruits of some of the newer varieties.

WHAT "APPALACHIAN APPLES" IS DOING

CARROLL R. MILLER, Sec'y-Manager, Martinsburg, West Virginia

Mr. President and Guests: I will present a few statistical results at the start to indicate the work and methods of Appalachian Apples. You are all rather familiar with it; many of you know it intimately; so I will not rehash at much length the fact that it is a voluntary association of the apple growers of the four states—Pennsylvania, Maryland, Virginia and West Virginia; that the fee is one cent per bushel on U. S. Utility or better grades; that it is controlled entirely by the growers through the state horticultural societies.

Appalachian Apples this season has placed 36,000 "store sets" of apple display material in fifty-three cities of the central east and the south. We are now working in New England—Boston, New Haven and New York where we have very heavy unloads of apples. Each of these store sets contains fifty-seven pieces. With 42,000 apple recipe books distributed, a total of two million pieces of apple advertising have been placed. Three of these store sets cost us one dollar, and we put them only where careful usage is assured. Most grocers also stage special displays of apples during the time they are using our materials; and the organized grocers have featured apples splendidly in their advertising.

While we work with the grocers and "the Trade" in each city, we are educating them slowly but surely to the uses of apples; their real sales and display values; the profit that lies in handling GOOD apples; the varieties that are best to buy, season by season, in order to meet consumer demands. The apple has remained a comparatively neglected item by the grocer, which is our fault. Growers of other fruits and vegetables, manufacturers of canned and processed foods, have been teaching the grocers and the public the merits of their foods for years. They have also told the grocers how to handle their products. You growers must teach these things about apples to the grocers. Nobody else will do it for you. You must do it steadily, consistently, continuously, by a trained group.

I wonder if you realize fully the importance of this market-development work. It stands out now as the most important job in apple-production. And it is the one on which we are putting the least money and work. Without profitable prices, year in and year out on the average, the grower cannot buy the equipment and supplies he must have to raise good apples. Without good apples, the already declining demand for apples will slip away much faster. We **must** have additional consumers and markets for our apples.

The King of Fruits used to rule almost without competition. After the summer months, except for a few pears, it was "apples or nothing" in the fruit line for the housewife.

Today, because of changed conditions in fruit and vegetable growing, and improved transportation under refrigeration and by truck, the United States Market News Report, for example, listed the other day **thirty-one** fresh fruits and vegetables arriving in the Baltimore market. This is about the year-round average. Thirty fruits and vegetables are now competing with apples all the time. Mostly they are better —and more honestly packed—than apples.

Getting back to what Appalachian Apples has done this season to promote public consumption of apples:— We have used newspaper advertising in generous quantities in twenty-eight newspapers of fourteen cities; have carried on radio programs in four regions—Atlanta, Washington, New York, and Philadelphia; have secured a tremendous acceptance of our apple publicity. We have in the office four great tomes of clippings, from 3520 dailies of the central East, South and Midwest, which have a total circulation of just under thirty-seven million copies. This publicity ranges from single apple recipes to full-page articles in rotogravure sections of the great eastern dailies, and to magazine covers. The N. W. Ayer & Son Advertising Agency, Philadelphia, is doing most of this publicity work for us. Since they are doing our advertising in newspapers and radio mostly, we have used many lesser avenues of promotion, such as fairs, festivale, "Big Apple" dance promotion, etc.

It is noteworthy that we have expended almost one-third of both our funds and efforts this season right in the state of Pennsylvania, with its ten million inhabitants. We have placed nearly 14,000 of our total 36,000 "store sets" in Pennsylvania: 8,865 in Philadelphia; 2,870 in Pittsburgh; 960 in Scranton; 780 in Harrisburg; and others in smaller cities. We had our heaviest advertising expense in Philadelphia, in "The Bulletin" and "The Record", and on Radio Station KGY; a heavy campaign expense in Pittsburgh, using the "Press and Sun-Telegraph." We used "The Times" in Scranton, and the grocer-service work in Harrisburg and several smaller Pennsylvania cities.

So much for our methods and our work. You will want to know something of results secured for your one cent per bushel. The apple-selling season is young yet, and we have not begun actively to check for results secured. That will come later. But we have some outstanding results already. The American Stores in Philadelphia, for instance, sold **Nine Carloads** more apples through their stores during our Appalachian Apples campaign in Philadelphia, December 9-23, than during the same period last year, with no campaign. The exact figures—10,448 bushels sold during the campaign, against 6,024 bushels the same two weeks last season. We have many such scattered instances as this already at hand.

The whole season's work will be checked in due time and results published in the Annual Report of Appalachian Apples.

We have found out a lot of things in our two years of active, day-by-day working with the Trade and grocers in all these cities of the East and South. We want to tell you some of the things these grocers and the Trade would tell you if you could call on them. First, we want to tell you what your culls are doing to your market for your better grades. We will outline this, step by step, just as it happens.

Your U. S. One Apples are selling, delivered, and wholesale, let us say, for $1.50 per bushel. The grocer who buys them must have a fifty per cent mark-up, to cover his business cost and a profit, so he must sell at $2.25 per bushel, or 4½ cents per pound—four pounds for 18c.

But—a trucker has come into town, loaded down with "drops", culls and "dirties." The trucker bought them from one of your growers for 25 cents a bushel; 200 bushels of them. **You** got $50 from that load and thought you had done a rather smart sales job. (Maybe you sold for 15 cents a bushel and got a $30 check that proved worthless.)

Anyhow, the trucker has $50 invested in that load of apples; some gasoline and truck-depreciation, and a couple of days time. If he can get $100 out of the load it will be a money-maker for him. Maybe he brought a load of green vegetables North; and just wants a "pay-load" back to help with expenses. He sells gladly for $100. The grocer who buys them pays 50 cents a bushel. Now this grocer also must have a fifty per cent mark-up. He prices these culls to his customers at 75 cents a bushel. His price card reads: "10 pounds for 15c". This grocer is two doors east of the grocer who bought the good U. S. One apples, priced "4 pounds for 18c".

The housewife, marketing, strolls along critically. There is the evidence: one grocery, 10 lbs. for 15c; the other grocery, 4 lbs. for 18c.

That's about all of this story. The rest of it is staring you in the face.

If the housewife is a particular friend of the grocer with the U. S. One apples, she may ask him, "How come you ask more for four pounds than that grocer asks for ten pounds?" The grocer can tell her the facts and point to quality; but that is long and tedious. Most women don't bother to ask. They buy at the store which is giving such "price values". The good apple grocer knows this, fully. So what does he do? He hails the next trucker he sees who is loaded with culls, drops and dirties; buys them; and puts a price card on them: "10 lbs. for 15c". He has to in order to stay in business. It's simply meeting competition.

And, the next time the wholesaler's salesman comes in and asks the good apple grocer about selling him some more of those U. S. One apples at $1.50, the grocer begins to swear. He winds up by saying something like this: You bring the price of those U. S. One apples down to 75 cents a bushel and I'll buy some. I can move some on their quality at that, against this "10 lbs. for 15c" stuff; but don't try to stick me with any more apples that I have to sell "4 lbs. for 18c"; not while this "10 for 15c" stuff is around.

So—No sale, on U. S. One's; and the wholesaler's stock of good apples stays on the floor, beginning to spoil. When he (the wholesaler) is approached next by the apple jobber, receiver, or broker, he growls, profanely. "Look on the floor there what your blankety-blank $1.50 apples are doing to me! Whenever you get me 17 cent apples, I'll buy some more. And not until!"

So, the receiver wearily calls up his Martinsburg or Winchester or Chambersburg apple-handler and says, "Can you make me a car here at 90 cents? I think I can coax a man to take them. Nothing stirring at $1.50."

And that, Mr. Grower, is **exactly** the way your culls affect your market price for your good apples. The Culls get the price! It's like water seeking always the lowest level.

Your market was "busted wide open"; not by too many apples, but by too many culls. The Law of Supply and Demand set the price at $1.50. "Culls" kicked the bottom out of that; set the market at 75 cents.

The fifty dollars you received for that truckload of culls knocked 75 cents a bushel off the 480 bushels in your load of U. S. Ones. Total knock-off, $360. Subtract the $50 for your load of culls, result $310 loss. Now multiply that by the number of carloads you shipped this season, to get the total cost of your cull business to you.

Here are some other broad results of this apple advertising work, as done by all the associations over the nation, including Appalachian Apples:

1. The price level this season has been almost exactly the same as for the 1935 crop. This year's crop was 20% larger than 1935's, which in itself was a big crop. When thirty-four million of bushels are piled on top of a big crop, it is natural to expect much lower prices. Then, too, this year we have run head long into the "recession". and buying of apples apong with everything else has been curtailed. In spite of all this, the price level has remained the same as in

1935 (until the past several weeks, anyway. I have not checked this for several weeks.) Certainly, then, some new powerful force has been at work in this season's deal. We know that this new force has been the advertising, the publicity, the grocer-service work, and the aid of the Organized Grocers, which we secured for your apples.

2. The Public's acceptance (consumption) of apples has been the greatest this year in history. We are receiving reports to this effect from all quarters and sections: the grocers, the Trade, the specialists. Up until December 1st, 162 million bushels of apples had been put into market channels of one kind or another. Last season to the same date, 84 million bushels had been marketed. The movement this season has been about double last year's.

3. The active aid of more than 50,000 of the largest volume grocers of the United States was secured, in the National "Apple-A-Day" Campaign which the chain stores are putting on for us, and the similar campaigns which the voluntary and independent grocery organizations are joining. These grocers have given us many thousands of dollars worth of their own newspaper, handbill, poster and radio advertising, featuring apples at their own expense. They have maintained splendid displays of apples; have pushed them to their customers. As a result of this, many hundreds of thousands of bushels of apples have been pushed across the counter into consumers' hands which otherwise would not have found a consumer outlet. We owe the chains, the organized grocers a tremendous debt of gratitude. Your own association, Appalachian Apples, organized and mobilized the other apple advertising associations of the nation, and the executives of the chains and other grocer organizations, to secure this tremendous help.

Another point I want to emphasize. We must make friends with the Grocer. He is our personal representative for apples to the Public, our only representative. If we do not like him and he does not like us; if he does not know anything about apples, he cannot be a good representative. He is human; and probably a little smarter in a business way than the apple grower. He has to be. The average grocer only stays in business four years. Competition is terrific. He has many, many problems. Make friends with him. Teach him about apples. Recognize that he must have a good profit on apples, or he will not push them. No man works hard for something in which there is little or no profit. You don't. You put no time nor effort on selling your culls because there is no profit in them. You put your time on selling your packaged good fruit, where the chance of profit lies.

The grocer does the same thing. Unless apples will furnish him a profit, he shoves them into the background; orders only enough to supply those customers who demand them. But if profits are "long" in apples, he will push them.

So, wish the grocer a good price and a fair profit, for your own good.

The Trade tells us that the "jumble packed" crate is arriving on markets "slack". This pack apparently does what it was designed to. It lessens bruising; but it runs into another equally serious flaw. It arrives too slack to be attractive to customers. Possibly you can devise "racking" or something to overcome this; but it must be overcome before the "jumble pack" can be a success.

In closing, I would emphasize that this apple-market development is a long-time job. We cannot expect to remake the nation's habits in one year, or two. It will be three years more, probably, before we will begin to receive the full benefits of this work which was started two years ago. But we do feel that we have helped the apple market this season very substantially; that the price levels would have been lower, noticeably, without this work by the several apple advertising associations of the nation, including your own Appalachian Apples.

DO PENNSYLVANIA ORCHARDS RESPOND TO POTASH TREATMENT?

R. D. ANTHONY, State College, Pa.

For many years we have discussed the relation of cultural practices and nitrogen fertilization to orchard growing in Pennsylvania. Recently questions have been raised as to the importance of fertilizer materials other than nitrogen. In field-crop growing throughout most of the state and in the cover crops in many orchards, the use of phosphorus has given as large response as we have secured from nitrogen. Because of these results, it has become a common practice in the state for fruit growers to use superphosphate along with some form of nitrogen. Very large sums of money have been used in advertising potash, and much potash has been used in orchard fertilization. Have fruit growers had a financial return from this outlay?

An apple tree responds so slowly to changes in soil conditions that long-continued tests of fertilizers are usually necessary to secure reliable results. Consequently we have had to draw heavily upon experiments dealing with field crops in order to get a better picture of the possible performance of potash in the apple orchard. We have been the more willing to do this because in the orchard we are growing two crops: a crop of fruit and a cover crop. We look to the former for an immediate cash return, but we look to the latter for the ultimate production of our trees.

As you all know, at State College the Jordan Fertility Plots for over half a century have been used to study the response of field crops to certain fertilizer treatments. In the report covering fifty years results it is stated: "Although potash did not increase yields when applied alone, it was used with profit with phosphoric acid and with nitrogen and phosphoric acid." It should be remembered that these fertilizer tests were with the usual four-year rotation in which a mixed clover and timothy sod was turned under.

In all the fertilizer tests conducted by the Department of Horticulture at State College and throughout the state up to 1937, only one has shown any suggestion of a return from potash. In a 12-year test started in one of the Tyson orchards at Flora Dale in 1907 on one of the Peidmont soils derived from shale, certain of the plots receiving potash were among the high yielding plots. Variations in slope and cover crop growth made it impossible to be certain how much of this yield was due to the fertilizer treatment.

Recently from other states there have been several reports of very satisfactory returns from the use of potash as an orchard fertilizer. Most of these tests have been on the

lighter, sandy, gravelly, water-laid soils. An area showing most serious injury from potash deficiency is that around the western end of Lake Ontario on soils that were deposited when that area was under a glacial lake. I had never seen a case of injury from potash deficiency in Pennsylvania until the summer of 1937 when C. O. Dunbar, Pomologist at the Arendtsville Laboratory, called my attention to several peach orchards in Adams, York, and Franklin counties showing abnormal growth conditions.

In southern York County, almost on the Maryland line, in a seven-year old orchard of several varieties of apples interplanted with peaches, approximately a third of the peach trees had no crop and showed abnormal growth conditions. In the rest of the orchard the growth and yield of the peaches semed normal. The apple trees were slightly smaller in the area where the peaches were affected but the leaves showed none of the marginal leaf scorch and mottling commonly associated with potash deficiency.

On the affected peach trees the leaves were pale, olive green in color with the edges bordered with red but with only an occasional leaf showing any marginal disintegration. Nearly all leaves were crinkled along the midrib and with the two sides rolled upward and inward toward the midrib with the under surface of the leaf exposed and showing much light red to pink discoloration. In extreme cases the leaves were rolled into a tight cylinder. Terminal growth was nearly normal in length but very slender. Similar abnormal conditions were found in a second orchard about a half mile away from the first orchard.

The soil is probably Chester clay loam, an important Piedmont soil of southeastern Pennsylvania. An analysis by Dr. Thomas of the Maryland Experiment Station showed it to be low in organic matter and deficient in almost everything except calcium and magnesium, being high in both of these.

The area in which the peach trees seemed to be normal had been under a corn wheat-hay rotation before the orchard was planted, but on at least one occasion had been planted to potatoes and during that year had been fertilized with a complete fertilizer containing a liberal amount of potash. The area showing abnormal trees also had been in the corn-wheat-hay rotation, but had never been planted to potatoes. The orchard has been fertilized with nitrogen only. Cyanamid at the rate of 3 to 4 pounds per tree was applied during the winter of 1936-37.

The orchard has been cultivated each year with a cover crop sowed about July first. During the summer of 1937 the difference in the cover crop in the normal and abnormal parts of the orchard was not great. In both cases the cover would be considered satisfactory although much of it was weeds.

The owner reports that differences in tree growth did not appear until 1933, two years after the orchard was planted.

When this orchard was first called to our attention it seemed reasonable to assume that some deficiency factor was responsible for the discolored, rolled leaves and absence of crop, but there seemed no clue pointing to any one element, so a series of treatments was planned containing as many as possible of the elements which have been used to correct abnormal plant growth. On July 2, 1937, groups of five peach trees with rolled leaves each had one of the following materials broadcast in a circle under the outer branches and worked into the ground to a depth of about two inches:

Nitrate of potash	3 lbs. per tree	Zinc sulphate	1 lb. per tree
Sulfate of potash	3 lbs. per tree	Copper sulfate snow	8 oz. per tree
Magnesium sulfate	1 lb. per tree	Nitrate of soda with 3 lbs. sulfate of potash	2½ lbs. per tree
Borax (20 Mule Team)	5 oz. per tree	Nitrate of soda	2½ lbs. per tree
Borax (20 Mule Team)	8 oz. per tree		
Sulfur (325 mesh)	3 lbs. per tree		
Ammonium alum	8 oz. per tree		

The night following these applications there was a rain of over three inches and the following month was unusually wet. Because of this, branch growth continued somewhat later than usual.

The first change in the appearance of any of the treated trees was noted on July 21, when the trees receiving the potash treatments showed leaves of a darker green color. Also those trees which had received sulfate of potash showed less folding of the new leaves than trees with nitrate of potash and, in general, the sulfate treated trees looked considerably better than those which had received nitrate of potash. Both were decidedly better than untreated trees. Trees fertilized with both nitrate of soda and sulfate of potash did not show the favorable change in appearance evident with sulfate of potash alone. No other treatment showed any improvement; if anything, trees receiving borax, magnesium sulfate and copper sulfate looked worse than untreated trees.

On August 3, five weeks after the application, the trees which had received sulfate of potash were nearly normal in appearance, especially the new growth. Even the older leaves which had been rolled and discolored when the potash was applied were now green and to a considerable extent had flattened out to more normal shapes. The nitrate of potash trees were intermediate between those which had received sulfate of potash and those untreated. The check trees and all other treatments showed no improvement or a continuing development of the leaf trouble.

On August 27, trees which had received either potash treatment looked nearly normal but close examination showed more rolled leaves on the nitrate of potash trees. From a hillside 300 yards away the potash treatments could be picked out.

September 15, ten weeks after the applications, the nitrate of potash trees still showed a considerable proportion of the older leaves rolled with some discoloration while the trees which had received sulfate of potash had large leaves of a healthy green color with very little crinkling. No other treatments showed improvement.

On October 15, after heavy frosts on the 9th and 14th, many of the leaves were still on the potash-treated trees while they were loose and falling rapidly from the other trees.

In November, terminal growth was measured and fruit buds counted by Mr. Dunbar. Terminals on trees which received potash were about the same in length as those without potash but they were considerably thicker in diameter. There were twice as many fruit buds per terminal on the potash trees as on the others. Terminals on some untreated trees had no fruit buds.

The response of these trees to potash applications by midsummer was so pronounced that orchards in other sections were examined for further indications of potash deficiency. Early in July, J. U. Ruef, Extension Pomologist, had noted a young peach orchard which was not growing normally. This was on one of the highest fruit farms in western Adams County, about 15 miles southwest of Gettysburg at an elevation above 1000 feet. This particular block of peaches was planted in 1936 on a Porters shale soil which has suffered serious erosion because of the steep slope. In preparing this field for planting the peach orchard, the land was terraced and the trees planted on the contour with one row on the terrace and three rows between terraces.

All but one row of these trees showed the same deformation, rolling, and discoloration of leaves as were observed in the first orchard reported. There was considerable variation from tree to tree, some being much worse than any seen in York County. The trees in a row planted on one of the large terraces seemed perfectly normal and were at least twice as large as the adjacent trees showing leaf rolling.

The grower's attention was called to these trees by Mr. Ruef, and on July 15 he applied two pounds of 3-12-6 fertilizer to each tree except the one normal row, and harrowed it into the soil.

On August 10, when Mr. Dunbar and I visited this orchard there were no signs of recovery from this application of com-

plete fertilizer made more than three weeks before. The next day, August 11, every other tree in half the orchard received a half pound of muriate of potash which was hoed into the ground for four to five feet around the tree. In the other half of the orchard, every other tree received half a pound of sulfate of potash. Again the row which seemed normal was untreated.

The first indication of any response was seen September first, when the leaves of a few of the potash treated trees showed a darker green than the untreated trees. By September 10, nearly all the treated trees had darker leaves with somewhat less rolling, especially near the tips of the longer branches. Recovery, however, was not as complete as in the York County orchard where the potash was applied July 2. No differences could be detected between the sulfate and the muriate.

The one normal row in this orchard was so different from the other trees that it could be picked out from the opposite hillside a quarter of a mile away. The previous winter this row had received a heavy application of barnyard manure. Neither the complete fertilizer nor the potash was used on this row. No sign of potash deficiency has shown at any time. On October 18, following a heavy freeze, the leaves were still green on this row while nearly all the other trees were bare.

During the latter part of the summer many peach orchards in York, Adams, and Franklin Counties were carefully scouted. Only one was found which showed marked symptoms similar to those in the two orchards discussed. This was on a sandy colluvial soil of low fertility on the west side of South Mountain. No work was attempted in this orchard.

In this south-central area of the state cases of potash deficiency in peach orchards are apparently rare. It has not been a common practice to use potash in the peach orchard fertilization program. The fact that a heavy potash application in the first orchard described seems to have supplied enough potash for normal peach tree growth for at least seven years, and the ability of a heavy application of manure in the second orchard to supply enough potash to prevent any deficiency symptoms from developing, suggest that the usual farm practices in this area have built up a moderate potash reserve.

These cases of potash deficiency are noteworthy because of the severity of the injury, the rapidity with which recovery followed potash applications when used alone and the apparent blocking effect of nitrogen when used with the potash.

Work in other states has shown that peach trees take up much more potash than do apple trees of similar size. English workers report that on soils deficient in potash certain varieties of plums will show serious injury several years before the apples among which they are interplanted show injury. Both at the U. S. D. A. Horticultural Field Station at Beltsville, Md., and at the New Jersey Experiment Station at New Brunswick, peach trees growing in pure sand and fed controlled nutrients quickly showed leaf discoloration and rolling similar to those described when potash was removed from the elements supplied, and recovery was quick when the potash supply was restored. However, under field conditions, even in cases of severe potash deficiency, surface applications of potash have usually been fixed in the upper soil layer and it has taken several applications before there has been deep enough penetration to reach the tree roots and check injury.

It is commonly reported that when one element is deficient, increasing the supply of the other necessary elements accentuates the deficiency symptoms of the lacking element. This is probably what happened when potash was used with nitrate and in a complete fertilizer.

A word more should be said of the performance of the manured row in the Adams County orchard. Not only did this manure contain potash in a readily available form, but its decay probably unlocked some of the potash in the soil which previously had been in an unavailable form. The Ohio Experiment Station has recently found as much as 1000 pounds of available potassium at a depth of 24 inches under a long-continued straw mulch when there was less than 175 pounds under annual cultivation.

Crops growing on the land take potassium from the soil and, when they are turned into the land and decay, this potassium is released in a very available form. In a bulletin just published the New York Experiment Station reports that a combination of legume and cereal crops in rotation will keep an amount of potassium in circulation equivalent to the annual application of 300 pounds of muriate of potash.

Do Pennsylvania orchards need potash? Of course, if potash deficiency signs appear in the trees. But again, tree response is liable to be too slow an indicator. If potash is so low in the soil that applications increase the cover which we can grow in the orchard, by all means use potash; at first perhaps as much as 200-300 pounds used alone and then small amounts in a complete fertilizer. If the orchard cover is heavy and occasionally is worked into the ground, it is quite doubtful if potash applications will pay.

NOTES ON INJURIOUS INSECTS

H. E. HODGKISS, State College, Pa.

A review of insect occurrence and damage in orchards indicates that during 1937 several relatively unimportant species of insects were destructive to tree fruits over rather wide areas. Some of the better known kinds, also, merit presentation. The purpose of this paper is to acquaint fruit growers with the vagaries of these insects, to suggest where suppression practices may be useful and to present data on the comparative values of insect control in apple orchards.

The topics selected for discussion are:

1. The apple seed chalcis.
2. Scarring of peach fruits.
3. The apple maggot.
4. The pear psylla.
5. Supplements for codling moth control.
6. Records of insect control.

The Apple Seed Chalcis

This insect is indirectly a source of trouble for fruit growers. The adult does not feed on the apple but the larvae develop within seeds of apples. They eat the inside of the seed completely. Damage to fruits occurs when the adult forces its ovipositor through the skin and flesh of small sized fruits and into the seeds. The entrance hole in the seed coat closes so that it cannot be detected. The path of the ovipositor through the flesh may be traced by a fine discolored line which extends from the surface to the seed capsule. These in themselves do not result in lowering the value of the apples. The important factor is a deformation of the mature apples due to depressions that occur around the point where the ovipositor was introduced. These may appear like needle punctures or the apples may be seriously deformed if the infestation of the insects is large. In one orchard 47 per cent of a crop of Golden Delicious apples were heavily infested.

Ordinarily malformations due to seed chalcis are noticed on small sized fruits of crabapples and the fruits of natural apple trees. This year we found the damage on the following varieties of cultivated apples in addition to natural fruits:— Ben Davis, Canada Red, Cortland, Crab Apples, Delicious, Golden Delicious, Greening, Grimes, Jonathan, MacIntosh, Rome, Snow, Spy, Stayman, Strawberry, Wagener, Wealthy, Winesap, and Winter Banana.

Control, if necessary, may be obtained through orchard sanitation. Collecting and destroying the fruits when thinning apples or during harvest will aid in keeping the insect in check. The removal of natural apples or other kinds of wild pome fruits will aid to eliminate the damage.

Scarring of Peach Fruits

A deformation of peach fruits commonly referred to as "cat-facing" was quite common last year in widely separate peach orchards. In Franklin county and in Lehigh county the injured peaches were only along the outer borders of the orchards adjacent to woodland. The injury was noticeable for a distance of ten rows in from the woods. In Lehigh county approximately 25 per cent of the peach fruits in the area stated was injured. Peach growers in Carbon, Juniata, Lycoming, Snyder and Union counties reported that similar injuries were prevalent in their orchards. In Clinton county two species of plant bugs **Lygus vanduzeei** Knight and **Lygus omnivagus** Knight were active late in June.

In Franklin and in Lehigh counties the injuries were caused by several species of stink bugs and plant bugs (Miridae). The stink bugs (Pentatomidae) have been recognized for years as being the outstanding cause of the deformity on peaches and on pears. Miridae have been suspected of some damage to peaches although the attacks of **L. invitus** on pears have been known to be destructive to pears.

Since the attacks of the Mirids on peach are caused only by the adults the only means of control is to eliminate as much of the succulent native tree growth on which the young nymphs feed. The most serious injury to peaches by the stink bugs has been observed in protected locations near woods or where the hibernating adults can obtain suitable winter protection. The adults are difficult to kill and there appears to be no insecticide which at this time can be recommended as a control measure against these insects.

Apple Maggot

The apple maggot appears to have increased in area of spread and insect abundance during the last ten years. It has become more abundant each year in Western Pennsylvania. Its importance has increased in orchards where fruits are destined for the export trade.

Attempts have been made in recent years to time sprays accurately for the control of the pest.

Our system of combatting it is well illustrated by the work conducted in the G. E. Templeton Estate orchard near Kittaning, Armstrong county. Here in 1934 the fruit crop was almost a total loss although the owner had attempted to follow our suggestions for its control. Beginning in the Autumn of 1934 different lots of infested apples were prepared for trap cages in order to time the emergence of flies during the next summer. Records from these cages were taken and used to time spraying periods in 1935, 1936 and 1937. Demonstration sprayings were conducted which were coincident with the timing periods in order to teach those

interested how thorough spraying functions as a control measure. Arsenate of lead was used as the insecticide at the rate of three pounds in 100 gallons of spray. Since 1935 the drop apples of susceptible varieties have been gathered and removed from the orchard. The infestation was reduced somewhat in 1935. In 1936 most of the apples were marketable. In 1937 only an occasional injured apple was found even in the most susceptible varieties.

The Pear Psylla

The pear psylla seems to have been unusually severe during 1937. One grower stated that his trees including leaves, fruit and bark were covered with sooty fungus which develops on the sticky fluid that results from the work of the psylla nymphs. This is the specific indication of damage from the insect and while many adults or nymphs may be working on pear trees during the summer the blackening of fruits and leaves is objectionable only after the insects have developed to numbers that result in a severe drain on the vitality of the trees.

The pear psylla was abundant in Carbon, Chester, Clinton, Delaware, Monroe, Montour, Northumberland, Schuylkill and York counties. A demonstration of its control was staged in Schuylkill county. A similar demonstration was carried on in York county. The grower stated that for the past three years his trees including leaves, fruit and bark were covered with a black sooty fungus growth caused by this insect. Most of the fruit was also unmarketable. This year the grower followed our advice and made a thorough spraying with a three per cent miscible oil spray in late spring while the trees were still dormant. Following this there was an application of concentrated lime sulphur and 40 per cent nicotine sulphate made just as the flower buds were separating in the cluster. The orchard was visited several times during the summer and examinations of the trees made without finding even a single psylla.

The psylla is not a difficult insect to control. Three plans are available: (1) Spray the trunks and lower branches of the trees with a spraying oil in the spring as soon as the early high temperatures draw the adult psyllas to the centers where they cluster in large numbers. (2) Spray the trees as the blossom buds develop into a "cluster bud" condition but while the blossom buds of varieties like Bartlett have not entirely separated in the cluster. Eggs have been deposited previous to this time and being about ready to hatch they can be killed by using lime sulphur solution diluted at dormant strength.

Since the stems of pears are somewhat susceptible to burning when the foliage develops pear growers should acquaint themselves with the proper period to avoid unneces-

sary stunting of the stems of young fruits and at the same time obtain a satisfactory kill of the eggs. (3) Spray the trees just as the "hard shell" nymphs begin to develop using either a nicotine sulphate-soap combination or nicotine sulphate-hydrated lime spray. The application should be made as the leaf petioles drop away from the stem and expose the nymphs. This will make it easier for the liquid to come in contact with them. Any one of these plans if properly used will control the pear psylla. It is advisable however in most instances to use either (1) and (2), (2) and (3), or (1) and (3) to insure a complete destruction of the insects.

Supplements for Codling Moth Control

One apple grower in Adams county was particularly interested in using larger amounts of lead arsenate than the ordinary three pounds that are recommended. Pre-season treatment was scraping and banding by June 15. Two adjacent blocks of Stayman trees about 18 years of age were selected for the comparison. At harvest in 1936 each block had 36 per cent of the fruits injured by codling moth. One block of trees received five pounds of lead arsenate; the other three pounds of lead arsenate in each of four cover sprays. The earlier applications were with three pounds of lead arsenate. Spraying was done on the same day by the same workmen.

The results of this comparison were taken at harvest. There was 5.2 per cent injury in the five pound block and 4.2 per cent injury in the three pound block. Samples collected for residue analysis showed that the lead in the residue amounted to .032 grains per pound of apples in the five pound block and .021 grains of lead in the three pound block. On November 11 six trees were taken at random in each block and the bands examined for codling moth larvae. In the five pound block four larvae were collected on the six trees while nine were taken from the six trees in the three pound block. In other words the additional material was not worthwhile.

In another orchard the program combined a thorough and timely spraying, made possible by bait pail records of moths collected and orchard sanitation. Sanitary measures included scraping and banding all trees with chemically treated bands and the screening of all picking crates and baskets. The program was followed in 1936 and 1937 and the condition at the close of 1937 is shown in Table 1.

Table 1. Comparisons of Codling Moth Control

Year	Per cent Fruit Injury at Harvest	Average Number of Larvae Collected Per Tree in Bands	Total Number of Moths taken in Bait Pails
1935	16.5		
1936	61.6	141	724
1937	21.0	32	467

In extreme Southeastern Pennsylvania codling moth was not considered to be important three years ago except in orchards. The past two years have shown that there has been a constant and general increase over the entire territory. In an orchard in Montgomery county at harvest 1936 there was a fruit infestation of codling moth of 51 per cent.

The program for 1937 was:

1. The placing of all picking crates and baskets in a storage cellar, the three windows of which were screened.
2. A definite spraying program using four cover sprays for codling moth at the rate of three pounds of lead arsenate in each cover spray.

The results of this program were outstanding. On July 8, 1937 with the storage still closed there were counted a total of 283 living and dead codling moths at one window. On November 10, 1937 the average number of larvae per tree banded was 46. Counts of apple infestation at harvest indicated that there was an infestation of 6.5 per cent which was a reduction of 44.5 per cent due to the program. This work is to be continued.

The scraping and banding of apple trees has come to be recognized as a definite aid in fighting codling moth. In Adams county 90,000 trees were scraped and banded out of a total of approximately 450,000 bearing apples in the county. What is happening under these bands is illustrated by a survey made in five counties in the Autumn of 1937 after all apples were out of the orchards.

Table 2. Results of Banding for Codling Moth.

County	Total Number of Trees	Total Number of Larvae Collected	Average Number of Larvae Per Tree
Adams	43	754	17.53
Dauphin	6	127	21.16
Franklin	16	740	46.25
Montgomery	19	811	42.68
York	8	458	57.25
Total	92	2890	31.41

The codling moth has been the most serious depredator of apples in the regions of extensive apple growing since 1930. The records taken in 349 apple orchards in 51 counties this year show that 210 of the orchards were sprayed completely according to our spraying information with an average codling moth damage to fruits of 1.5 per cent. In 125 other orchards where only part of the suggestions were used the codling moth damage to fruits was 13.2 per cent. In 14 unsprayed orchards the loss due to codling moth was 34.4 per cent. These percentages may be compared to the averages of the last eight years which were, complete spraying 2.1 per cent; incomplete 11.7 per cent; and unsprayed 40 per cent.

Values in Insect Control

The value of insect control to apple growers was emphasized by figures obtained in 360 orchards in 51 counties which was a representative cross section of the apple industry. The orchards were selected at random. Some of the owners had followed the suggestions exactly, others had used only part of them or the spraying job had been poorly done, and a few orchards were unsprayed. In 160 completely sprayed orchards the insect injuries totaled 3.3 per cent; in 186 partly or poorly sprayed orchards the insect injuries were 15.3 per cent; while in 14 unsprayed plantings the average insect damage was 68.2 per cent.

This system of measuring results was started by us in 1928. The average insect injury from 1928-1937 inclusive, in 1,052 completely sprayed orchards was 4 per cent; in 1,501 incompletely sprayed orchards, 18.6 per cent; and in 137 unsprayed orchards 63.9 per cent.

In earlier reports insect damages have been expressed also in terms of monetary valuations. This year the insect losses in 160 completely sprayed orchards amounted to $32,070 out of a yield valued at $1,459,721. In 186 incompletely sprayed orchards having a yield valued at $1,060,199 the insect losses amounted to $104,039. The apple trees in 14 unsprayed orchards yielded 22,560 bushels of apples of which 12,412 bushels valued at $6,206 were destroyed by insect attacks.

REFRIGERATION FOR FRUIT STORAGE

By F. G. HECHLER

Every fruit grower is interested in keeping his fruit in the best possible condition until it can be profitably sold and to do this at the lowest possible cost. The production and marketing of quality fruit involves many problems, the answers to which you know much better than I do. I am not a horticulturist but, having been reared on a farm and having been in rather close touch with rural conditions, I have an appreciation of the problems and I hope that a discussion of some phases of fruit storage from an engineering viewpoint may be helpful.

It is unnecessary to discuss the advantages of proper storage conditions with this audience. You all know that fruit is a living organism which during the ripening process in storage gives off carbon dioxide and water vapor with the liberation of heat. Low temperatures retard this ripening process and prevent softening of the fruit. For most varieties of apples a temperature slightly above 32°F., the freezing temperature of water, seems to give best results and to insure keeping the fruit in prime condition for the longest time. Different varieties of apples behave differently, but tests have shown that each bushel of apples will give off the following amount of heat expressed in B. t. u. per 24 hours.

Storage temperature 85°F.	—	165 to 385 B. t. u.
Storage temperature 40°F.	—	27 to 44 B. t. u.
Storage temperature 32°F.	—	16 to 22 B. t. u.

The very rapid decrease at the lower temperatures is apparent and shows why low temperatures are desirable. This also suggests the importance of cooling the fruit as rapidly as possible after picking in order to arrest the ripening process. We shall return to this question later in the discussion.

Rapid cooling and the maintenance of low temperatures make mechanical refrigeration a necessity and this brings us first to a consideration of the construction of the storage itself in order that the required temperatures may be economically maintained.

In designing fruit storages it is customary to allow 2½ cu. ft. of volume per bushel of apples, which is the fruit for which farm storages are usually built. The inside height of the storage room is usually 10 or 12 feet, depending on the height to which the fruit is to be stacked and on the method chosen for cooling the room. About 40 feet is a convenient width and one often chosen for moderate-size storages. On this basis the size of a room for 10,000 bu. of apples would be 40 x 62½ x 10 feet, allowing the necessary space for aisles and clearance along the sides, top, and between the packages for free circulation of air.

The kind of construction will depend largely on the avail-

ability of materials and on the need for keeping first cost as low as possible. Almost every kind of material has been satisfactorily used, but it should be remembered that generally the lower the cost the shorter the useful life of the structure is likely to be. Sometimes, of course, the availability of local materials, such as seconds or culls of building tile, brick, etc., makes it possible to build a permanent structure at a moderate cost. Regardless of the material used the workmanship should be of the highest quality to insure a satisfactory job.

A wooden structure is often the cheapest and when properly built and maintained will give years of service. However, because of its greater permanence and reduced fire hazard, masonry construction using stone, brick, tile, or concrete blocks is to be preferred.

Insulation. No matter what kind of structure is used it will have to be well insulated if mechanical refrigeration is to be used. The minimum amount of insulation that should be used for an apple storage for a temperature of 33 to 35 degrees is 4 inches of corkboard or its equivalent. This is in addition to the usual wall construction. Doors of adequate size should be provided and arranged to give good ventilation through the storage when opened. A vestibule or anteroom is desirable for all refrigerator doors. It is difficult to build a satisfactory home-made refrigerator door, and, while rather expensive, the commercial product is a good investment. Generally no windows or other openings should be provided except the doors.

All materials used in the construction of a building offer some resistance to the passage of heat and might, therefore, be regarded as insulation; in practice, however, insulation means a material having a relatively high heat resistance per unit thickness. For example, cork is universally regarded as a good insulation and is the yardstick by which all other materials are compared, while concrete, for which we need approximately 40 inches to provide the same heat resistance as is given by 1 inch of corkboard, is a poor insulation. In general the lighter and more porous the material the higher its insulating value. There is one apparent exception to this general statement. For example, sheets of aluminum foil can be arranged to give a very high thermal resistance although aluminum itself has a thermal conductivity nearly 5000 times that of corkboard. The explanation, of course, is that in this case we are dealing with the transfer of heat principally by radiation and not by conduction as in the case of cork and concrete. This suggests the importance of a thorough knowledge of the three methods of heat importance of each under different conditions, so that materials may be used to best advantage.

Types of Insulation. Insulation for use in cold storage construction is available in various forms and in a great variety of materials. The principal structural kinds are: loose fill or bat types to be poured or fitted into place; blanket or flexible sheet type, usually made of vegetable or mineral fibers enclosed between sheets of strong paper; rigid or board type, made of granular material compressed and baked or of fibres felted together with or without an artificial binder; thin sheets of metal which are effective only if the surfaces are bright and exposed to air spaces. The raw materials from which these insulations are made include wood bark, wood fiber, sugar cane fiber, straw, cornstalks, hair, seaweed, kapok, licorice roots, peat, asbestos, gypsum, rock, rubber, glass, vermiculite, aluminum, steel, etc. Common building materials like wood, stone, brick, tile, concrete, etc., which are used primarily for structural purposes, are not classed as insulation.

Properties of A Good Insulation. A good insulation should have the following properties:

(1) High insulating value.
(2) Resist moisture absorption.
(3) Fire resistant.
(4) Neither attract nor harbor vermin or rodents.
(5) Reasonable in cost and easily applied by available labor.
(6) Odorless.
(7) Permanent for the anticipated life of the structure.

Many of the materials now available do not meet all of these requirements and it is the builder's problem to select the one that will give the maximum return per dollar of first cost and that adequately meets all of the requirements that are important. For cold storage work good insulation and moisture resistance are perhaps the most important. Many materials have a high insulating value when dry, and it is well to remember that practically all values given in the literature and used for design purposes are for dry materials. Unfortunately when used for cold storage insulation it is difficult to keep the material dry. Because of the difference in temperature and humidity inside and outside there is a movement of air through the wall unless it is perfectly sealed. This air carries moisture with it; the warmer the air the more moisture it can carry. As it passes through the wall from a warmer to a colder zone its ability for carrying moisture gets less and less until at the dew point it is just saturated and any further lowering of the temperature will result in the condensation of some of the moisture. If the temperature falls below 32°F. frost will form. Both water and frost are destructive to the insulating value of the materials and if allowed to remain may cause chemical or physical breakdown and decay of the structural frame. When a

storage is used continuously, or for the greater part of the year, the accumulation of moisture in the wall may become serious because of the difficulty in drying out the walls in the short time available. Obviously the fill type of walls are most adversely affected by moisture. The solution might be to adopt the commercial cold storage construction of a solid masonry outer wall insulated with rigid board type of insulation laid in asphalt to exclude moisture. Economically such a construction may not, however, be justified for farm use and a compromise solution must be found. A good grade of building paper with an asphalt or metal foil covering and well lapped and cemented at all joints is helpful in preventing moisture penetration if applied on the outside. At the same time the outside of the wall should not be sealed in any way.

Air spaces as usually used in walls are not very effective insulation, neither do they prevent moisture condensation. If the usual air space in a 2 x 4 or 2 x 6 wall is divided into a number of narrow spaces ¾ inch to 1 inch wide by inserting a sheet of insulation or waterproof paper between the studs, the insulating value will be much improved but we will still have moisture condensation.

Where mechanical refrigeration is used the floor of the storage needs insulation as well as other parts of the structure. The kind of insulation to use depends on the kind of storage. For an apple storage we believe that 2 or 3 feet of screened steam cinders are adequate and they have the advantage of making it easier to maintain the proper humidity. The chief criticism of this construction is the lack of a good smooth floor such as is provided by a concrete floor. With a concrete floor 4 inches of corkboard insulation, or its equivalent, should be used under the floor.

The following table gives the relative insulating value of some common materials. The values, except where otherwise indicated, are for dry materials. It should be remembered that the arrangement of a material in a wall often affects its insulating value greatly and that moisture in a storage wall is destructive.

Relative Insulating Value of Materials

Material	Approximate Weight lb./cu. ft.	Thickness required for insulation equivalent to 1" of corkboard Inches
Corkboard	8-10	1.0
Regranulated Cork	6	1.2
Brick, common	132	16.5
Cinders, dry, screened	38	4.0
Cinder Concrete	110	17.3
Cinder Blocks (8"), one air space	----	16.5
Cinder Blocks (12"), one air space	----	20.4
Concrete Blocks (8"), one air space	----	26.6
Concrete Blocks (12"), one air space	----	31.9
Concrete	140	40.9
Hollow Clay Tile (4")	----	13.3
Hollow Clay Tile (6"), two air cells	----	12.8
Hollow Clay Tile (8") two air cells	----	16.0
Flexible, blanket insulation	1-10	0.9
Rigid Board Insulation	10.20	1.1
Flaked Gypsum	24	1.6
Mineral Wool	2-10	1.0
Plaster Board (½")	50	4.7
Sawdust, dry	10	1.7
Shavings, dry	8	1.7
Stone	135	42.0
Stucco, cement	----	40.0
Soil, dry	----	4.0
Soil, wet	----	16.5
Wood	28-45	3.3

One air space is equivalent to 0.3 inches of corkboard.
Metallic insulation with one surface facing an air space is equivalent to 0.5 inches of corkboard.

Refrigeration. The choice of a refrigerating system is often a difficult problem and the layman usually finds himself hopelessly at sea when he tries to compare various recommendations and proposals. At the present time for the

type of plant under discussion, we find very few brine cooling systems being installed; it is cheaper and just as satisfactory to use direct expansion, thus eliminating the intermediate transfer of heat through a circulating brine. In the direct expansion system the high pressure liquid refrigerant is allowed to expand to a lower pressure into pipe coils placed in or adjacent to the storage room to be cooled, which gives the system its name. In the coils the refrigerant changes to a vapor, that is, boils at a low temperature; the heat necessary comes from the storage room, resulting in the desired cooling. The vapor passes to the compressor and condenser where it returns to the liquid state by giving up heat and is again ready to pass through the same cycle. The author believes that at present the direct expansion system as outlined above is the most satisfactory system for general use. He is, of course, well aware that many will not agree. The so-called "air-conditioning" systems have ardent supporters and systems of this type have in some cases given excellent results. Developments in this field have been very rapid during the past few years and will no doubt continue for some time to come. Since these systems do not perform all of the functions properly included under air conditioning, they should not be so classified. Generally they are adaptions of unit coolers combining a refrigeration system with a fan system circulating air through the storage usually with provision for humidification. The air is usually drawn from the room, passed over a direct expansion cooling coil, and returned to the room, thus maintaining a more or less positive air movement through the room. The preferred location for the unit seems to be outside of and adjacent to the storage. This makes it convenient for servicing and keeps the connections short. In some designs ducts are used to distribute the air in the rooms while in others the air is merely blown into the room near the ceiling at one point and withdrawn from another near the floor. In the interest of economy, only a small amount of fresh air is admitted, although provision is usually made to take all fresh air at times when the outside temperatures are right.

From a performance standpoint, there is little choice between the use of ammonia as a refrigerant or some of the other fluids commonly used, such as Freon. For air systems Freon, because of its relatively non-toxic properties and because the pressures required for storage refrigeration are relatively low, is likely to be the choice. For the direct-expansion pipe coil systems ammonia is still a favorite, and where temperatures much below freezing are required it has definite advantages.

Experiments have shown that for most varieties of apples temperatures near 32° are best and insure the longest stor-

age period. Nevertheless there appears to be a tendency to use higher temperatures of from 35 to 38 degrees in air storages. This permits the use of a higher refrigerant temperature in the cooling coil so that frosting of the coil is avoided. In this case too, moisture removed from the circulating air merely condenses on the coils and runs off, thus avoiding the necessity of periodic defrosting.

While air movement in a fruit storage is desirable, excessive air motion should be avoided because it increases moisture removal which may cause fruit to shrivel. Frequently some provision must be made to add humidity to keep fruit in good condition. A humidity of about 85% is usually recommended. A good hygrometer to indicate the relative humidity in the storage is very helpful to the operator in maintaining the desired conditions; next to a thermometer it is probably the most essential instrument in any fruit storage. In the direct expansion coil system air movement within the storage is usually a minimum and fresh air is usually obtained by opening doors or ventilating flues with or without fans. If the building is properly designed so that through drafts can be obtained by opening doors at opposite ends when outdoor conditions are favorable, adequate ventilation can be obtained. When the outside temperature approximates that of the storage during the winter, the relative humidities are usually not greatly different so that drying is minimized when the doors are opened for ventilation. Controlled temperature and humidity with adequate ventilation are all essential for any successful cold storage.

Size of Equipment Required. It has frequently been the experience of fruit growers planning a cold storage installation to receive proposals in which the equipment recommended for a certain job varied between wide limits, sometimes as much as 100 per cent or more. Such variations are generally due to a lack of precise information regarding the requirements to be met. Suppose A and B each have storages of 10,000 bu. capacity, of identical construction and insulation. Assume, however, that A wants to fill his storage at the rate of 1000 bu. per day while B plans on 500 bu. per day; further assume that A wants to move the fruit directly from the orchard into storage regardless of possible high outdoor temperatures while B is willing to stack the fruit in an open shed where it can cool off over night before it goes into the storage. Obviously the requirements in the two cases are entirely different although both storages are the same. It can be readily seen, therefore, that, unless the request for bids definitely fixes the rate at which the storage is to be filled, the temperature at which the fruit goes into storage, the temperature at which the storage is to be held,

the rapidity with which the fruit is to be brought down to the storage temperature, and the temperature of condensed water available there is no reason to expect the proposals to be based on equipment of the same capacity. Some of our best manufacturers are inclined to be rather conservative in order to protect their own reputation by proposing equipment with a margin of safety, especially where there is any question regarding the accuracy of conditions assumed or the faithful adherence to the rate of filling. On the other hand instances have been brought to our attention where in order to quote an attractive price the installation has been woefully undersize and utterly unable to produce cold storage conditions.

The desirability of rapidly cooling the fruit to a low temperature is generally recognized, but it requires additional refrigeration capacity which adds materially to the cost of the installation and which is needed only for a short time each year. During the greater part of the storage period very little refrigeration is needed. This problem is sometimes met by installing two units of sufficient capacity to handle the peak load when running continuously. At other times one unit can take care of the requirements when operating not more than 16 hours per day. This initial peak load can be materially reduced in many cases by taking advan-

tage of the lower air temperatures at night to pre-cool the fruit before putting it into storage. The value of this is shown by the following data: the specific heat of apples is about 0.9, a bushel of apples weighs 48 lbs., assume that the fruit comes from the orchard at 75° and that by storing outside over night this can be reduced to 65°. Under these conditions the heat removed from 500 bu. of apples would be:

500 x 48 x 0.9 (75-65) equals 216,000 B. t. u.

The capacity of a machine to remove this heat would depend entirely on the rate at which the cooling is to be done; if in 12 hours the equivalent tonnage rating is 1½; if in 24 hours only ¾ ton, assuming continuous operation, but in any case a very sizeable item. Where lower night temperatures cannot be depended upon for cooling, the use of a precooler room adjacent to the storage may be advisable. This is cooled to an intermediate temperature by a separate unit operating at high capacity and efficiency; a second handling of the fruit into the storage is necessary. If two units are used one should have twice the capacity of the other to provide flexibility and lowest operating costs. Because of the many variables involved, it is difficult to fix the size of machine required. Roughly, however, under average conditions and for a well insulated storage, about ½ ton of refrigerating capacity per 1000 bu. capacity will be satisfactory. On this basis a 10.000 bu. storage would have a 5 ton machine. This would take care of 500 bu. of apples per day and permit cooling them to 35° within 24 hours and also take care of heat leakage into the storage.

Automatic Controls. Automatic control of the operation of the refrigeration system is highly desirable and the additional cost is usually warranted. Developments in this line have been rapid in the past few years, particularly for units using Freon where several rooms are handled with one unit. Like all other mechanical devices, however, automatic controls require careful attention and occasional servicing. Never, unless the storage is visited at least daily, put sole reliance in one automatic control. An independent warning signal that will give an alarm if the temperature should drop dangerously low—or get too high—should be installed. The added assurance will give the owner a better night's rest. If the owner has the time and the inclination, very satisfactory results can be obtained by manual regulation; in this case the machine would be provided with independent safety controls to protect the unit but not the contents of the storage.

Landscaping and Painting. The value of landscaping the fruit storage is often overlooked; grass, shrubbery, and trees not only have an aesthetic and sales value, but they ac-

tually reduce the refrigeration load during warm weather. In the same way paint is not only a preservative; it reduces the heat load in the summer provided the proper colors are used. White paint absorbs the smallest amount of heat from the sun, much less than most other colors and considerably less than aluminum paint. Aluminum paint on the other hand is much better than white paint for the inside of the storage because it transmits less heat at this temperature and also because it gives an attractive finish.

WHEN SHOULD APPLE TREES BE PRUNED?*

F. N. FAGAN, State College, Pa.

We can suppose that as long as men grow apple orchards for profit that the old question of pruning the trees will still be a subject for discussion. This has been the case in the past history of the industry and will likely continue in future years. Much has been published on the subject. For many years an old saying was, "Do the pruning any time the saw is sharp." Some growers went so far as to do summer pruning; however, this practice never developed to any extent. As owners increased their plantings to a larger number of trees and trees increased in size, the job of pruning became more of a task. Pruning labor with good judgment and training was scarce. An owner of a large number of trees was forced to begin pruning as soon as apple harvest was over in the fall, if he expected to get over his trees before the rush of spring work began the next season. During the last fifteen years an increasing amount of fall and early winter pruning has been done and not until the severe winters of 1933-34 and 1935-36 was any great number of questions raised regarding the advisability of doing the work at this season of the year. A few of the older growers questioned the late fall pruning but they were in the minority. It begins to look as if the minority was right.

During the two years mentioned, severe winter temperatures along with heavy snowfalls put a sudden stop to fall and early winter pruning work in a number of orchards, and no more pruning was done until the following early spring. During the following growing seasons these owners began to note that their most severely winter damaged trees were to be found in the blocks where the trees had received pruning in the fall and early winter before the low temperatures occurred. They noted not only winter injury to the cambium layer around pruning cuts resulted in no healing, but in addition to this the trunk injury was present to a greater extent in the blocks having received fall and early winter pruning.

The writer has seen enough examples of this winter injury following the hard winter of 1933-34 to cause him to

question very seriously the advisability of doing any fall, early winter, or even midwinter pruning. If man could predict what kind of temperatures were to follow November and early December, then fall and early winter pruning would be safe. Man cannot do this, however.

Besides this "time of pruning" question, the writer wonders whether there has not been developed a trend to overprune bearing apple trees. It is true that it is necessary to do some apple tree cutting in order (1) to keep trees within working range of height, (2) to keep the spread of branches from reaching from row to row, thus blocking driveways between rows, where various orchard tools are used, (3) to keep the trees from becoming so bushy that good spraying and thinning cannot be given, and make picking more economical. The writer brings this amount of pruning, rather than overpruning idea, up for some thinking. Have we been doing more pruning than is needed to meet the needs of items 1, 2, and 3, and by so doing reducing total yields? Will the amount of pruning to meet 1, 2, and 3 still produce crops grading a 85% to 95% U. S. No. 1 pack? The writer believes it possible.

The cost of pruning bearing apple trees is rather high. It may be that total production cost can be reduced some if we give this pruning question some serious thoughts.

*This article appeared in the December issue of the State Horticultural Association News, but is being repeated in order to incorporate the questions and answers following the discussion on pruning.

Question 1. What is the effect of painting wounds soon after cutting?

Griest

Answer: Most wound paints or dressings do not stick or adhere well to fresh cuts. In most cases the dressings will adhere better if the wound surface is permitted to dry for a day or two before applying paint or dressing.

Question 2. What materials would you suggest as wound paints?

R. J. Gillan

Answer: A good white or red lead paint made without a "dryer". Several makes of tree wound paints are on the market made with asphalt as a base. Many of these compounds are very satisfactory.

Question 3. Which ones stick best on wet wood? What about durability of compound?

Griest

Answer: The cold water asphalt compounds seem to spread over and adhere better to the wet cut than the lead paints.

Question 4. Would protection be sacrificed if painting were delayed until wood had dried?

Rittenhouse

Answer: Yes, to some extent. But when pruning is done in the true dormant season there is little danger, for even then the wounds can be painted before any growth begins.

Question 5. Is it advisable to cut limbs two inches or more in diameter to stubs two feet long, and cut closely in spring?

Worthington

Answer: Yes. The short stubs in the case of larger branches would offer protection against winter damage. The stubs to be removed in the spring period after danger of low winter temperatures had passed.

Question 6. What experience have you had with Sherwin-Williams tree paint?

Voss

Answer: Have had no experience with this make but would be surprised if it did not prove satisfactory.

Question 7. Any objection to lamp black?

Voss

Answer: We can see no objection to lamp black being added to a wound paint. A black brush grafting wax containing lamp black has given good results.

Question 8. Were early pruned trees injured?

Musser

Answer: Yes, trees pruned before the low temperatures showed more damage in many locations than trees not pruned until the following spring period. (Musser) This was true in our apple orchard.

Question 9. Is there any information on chemical content of wood as related to winter injury.

Loop

Answer: There likely is a difference but we have no information along this line that would lead us to believe there is much we can do about it.

Apple trees that produced extra heavy crops in the falls of 1933 and 1935 in many cases were winter damaged more by the low temperatures of 1933-34 and 1935-36 than the trees that had been light croppers in the same years.

Trees of low vigor or poor growth were damaged more than trees of normal or good growth.

All of this indicates that "chemical content" of trees may play a part in some cases of winter injury.

Question 10. Were any of the winter injured trees painted?

Griest

Answer: No, not until after the damage had been done.

Question 11. When do northern growers in colder sections prune?

Gillan

Answer: I rather suspect more of their pruning is being done in the spring period. At least more so than has been the recent practice of Pennsylvania growers.

Question 12. What effect does pruning have on color?

Passmore

Answer: The removing of weak, thin branches will improve the percentage of high-color fruit at harvest time.

Question 13. Cannot early and late pruning be credited and discredited in the same orchard?

Linde

Answer: Yes, to some extent. But in many locations very little winter damage could be found on trees that had not been pruned before the low temperatures had visited the orchards, while much damage was to be found on trees pruned before the low temperatures occurred.

Question 14. Would summer pruning change the situation?

Linde

Answer: We do not know. General summer pruning has not been very successful, or we would find more growers doing summer pruning.

Question 15. What about late spring?

Linde

Answer: Late spring pruning is very satisfactory, but pruning after the buds open and the first green leaves unfold would be a little too late for most growers.

Question 16. Would heavy pruning of peaches be in the same class?

Bingham

Answer: Yes. From the winter damage we have seen, I believe I would say do no peach pruning until after the danger of low winter temperatures has passed.

Question 17. What is the effect of early pruning of peaches?

Griest

Answer: The early winter pruning of peach trees has not been very satisfactory with us. We would rather do this work in late winter or early spring. We can tell then more about the way the fruit buds have come through the winter.

Question 18. Is it advisable to leave brush on the ground?

Bingham

Answer: In most cases it is not advisable to cut the brush into short pieces and leave it on the ground.

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Fisher, Isaac	Gordonville	Lancaster
*Fletcher, S. W.	State College	Centre
Flinchbaugh, H. H.	Loganville	York
Flinchbaugh, J. J.	Loganville	York
Flora Orchard Co.	Wrightsville	York
Forry, S. E.	Ephrata, R. 1	Lancaster
Frantz, S. P.	Trucksville, R. D.	Luzerne
*Freed, A. J.	Racine	Beaver

* Life Member.

Name	Address	County
*Freed, W. A.	Racine	Beaver
French, A. L., Secy., N. H. Horticultural Society	Hennicker, N. H.	
Frey, H. E.	Red Lion No. 2	York
Fry, John L.	c/o C. K. Whitner & Co., Reading	Berks
Funk, Sheldon	Boyertown	Berks
Gackenbach, C. A.	Orefield, R. 1	Lehigh
Gantert, Theo.	152 N. Front St., Reading	Berks
Garber, Henry F.	Mt. Joy, R. 3	Lancaster
Gardenhour, G. W.	Smithsburg, Md.	
*Garrahan, R. H.	Kingston	Luzerne
Garrettson, Donald	Aspers, R. 2	Adams
Garrettson, Robert	Flora Dale	Adams
Garvey, Dr. T. Q.	443 W. Chestnut St., Lancaster	Lancaster
Gaul, Franklin P.	Host	Berks
Gay, Arthur	Dallas, R. D. 1	Luzerne
Gehr, Harvey J.	Waynesboro	Franklin
Geiger, Clinton	Neffs	Lehigh
Geiger, Samuel	Schnecksville, R. 1	Lehigh
Gelwix, John M.	Chambersburg	Franklin
General Chemical Co.	1 S. Broad St., Philadelphia	
Getz, Kenneth	North Girard	Erie
Gibson, C. V.	Connoquennessing	Butler
Gibson, G. Meade	Mercer, R. D. 1	Mercer
Gibson, Ira E.	Blairsville, R. 1	Indiana
Gibson, W. F.	Yoe	York
Gillan, R. J.	St. Thomas	Franklin
Gillan, C. F.	St. Thomas	Franklin
Gillan, G. G.	St. Thomas	Franklin
Glick, Jonas R.	Gap, R. D. 2	Lancaster
Goldman Package Mfg. Co.	Glassboro, N. J.	
Goldsborough, E. L.	Shepherdstown, W. Va.	
Good, Harvey	Lancaster, R. 8	Lancaster
Good, Walter	East Earl	Lancaster
Goodling, G. A.	Loganville	York
Gorman, James	9 Hillside Ave., Freeport, N. Y.	
Gosart, Chas.	Box 261, Shavertown	Luzerne
Goshorn, Taylor L.	Box 47, Quincy	Franklin
Gossert, W. E.	Waynesboro, R. D. 1	Franklin
Gramm, H. V.	St. Thomas, R. 1	Franklin
Gray, E. G.	American Fruit Grower, Hagerstown, Md.	
Graybill, C. W.	Middleburg, R. 4	Snyder
Graybill, Floyd	Richfield	Snyder
Graybill, J. H.	Manheim, R. 1	Lancaster
*Griest, Frederick E.	Flora Dale	Adams
Grimshaw, Harry	North Girard	Erie
Gross, H. S.	York, R. D. 10	York
Group, Foster C.	Gardners	Adams
*Grove, W. E.	120 N. 6th St., Chambersburg	Franklin
*Grove, W. E.	York Springs	Adams
Guyton, T. L.	Sherwin-Williams Co., Bound Brook, N. J.	
Haas, William	Coplay, R. D. 1	Lehigh
Haase, Alfred H.	Narrowsburg, N. Y.	Wayne
Haase, Herman	Narrowsburg, N. Y., R. 1	Wayne
Haberman, Mrs. T. C.	Baden	Beaver

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Name	Address	County
Hackenburg, Grant	Middleburg, R. 1	Snyder
*Haddock, John C.	Wilkes Barre	Luzerne
Hafer, Fred	Waynesboro, R. 1	Franklin
Hafer, Harry D.	Fayetteville, R. 1	Franklin
Hafer, John A.	Chambersburg, R. 5	Franklin
Hafer, Quigley	Chambersburg	Franklin
Hafer, Roy	Fayetteville, R. 1	Franklin
Haim, S.	Trout Run	
Haines, Robert B. 3rd	Hereford, Box 56	Philadelphia
Hall, Joseph	Orrtanna	Adams
*Hall, L. C.	North Girard	Erie
Hann, Jesse	Hunlocks Creek	Luzerne
Harrisburg Stencil Works	4 N. 5th St., Harrisburg	
Harrison's Nurseries	Berlin, Md.	
Hart, A. L.	Hardie Mfg. Co., American Hotel, Reading	Berks
Hartman, Clem A.	Cashtown	Adams
Hartman, Ernest	Biglerville	Adams
Hartman, Scott W.	Palm	Montgomery
*Hartman, L. E.	Clay	York
Hartman, M. T.	Gettysburg	Adams
Harvey, Clyde	Northbrook	Chester
Harvey, H. R.	Foxburg	Clarion
Hassinger, Sam	Middleburg, R. D.	Snyder
Hassinger, H. C.	Beavertown	Snyder
Haudenshield, Chas.	Noblestown Road, Crafton	Allegheny
Haudenshield, Crist L.	Mt. Oliver No. 6, Pittsburgh	Allegheny
Hausman, George B.	Coopersburg, R. 2	Lehigh
*Haverstick, Paul E.	Lancaster, R. 3	Lancaster
Hawkins, E. B.	Delta	York
Hayes, S. B.	Enon Valley, R. 1	Lawrence
Hayman, Guy L.	Northbrook	Chester
Heacock, O. J.	Biglerville	Adams
Hege, H. P.	Fayetteville, R. 1	Franklin
Hehnly, J. H.	Hopeland	Lancaster
Heinz, Henry	Narrowsburg, N. Y.	Wayne
Heisey, S. A.	Greencastle, R. 4	Franklin
Heller, Alex	Trout Run	Lycoming
Helmbrecht, Frank	East Springfield	Erie
Hempstead, Walter	River St., Honesdale	Wayne
Henderson, John G.	Edri	Indiana
Henderson, Lowrie	Stoneboro, R. D.	Mercer
Herr, C. H.	Lancaster, R. D. 6	Lancaster
Herr, I. H.	Lancaster, R. D. 6	Lancaster
Herr, J. Z.	Elizabethtown College, Elizabethtown	Lancaster
Herrick, R. S., Secy., Iowa State Horticultural Society	Des Moines, Iowa	
Hershey, H. S.	East Petersburg	Lancaster
*Hershey, H. F.	Hamburg	Berks
Hess, Fred E.	Nescopeck, R. D.	Luzerne
Hess, F. M.	601 Main St., Waynesboro	Franklin
Hess, Paul G.	Waynesboro, R. 1	Franklin
Hess, Ray B.	Waynesboro, R. 2	Franklin
Hess, R. C.	Waynesboro, R. 2	Franklin
Hess, T. S.	Wapwallopen, Box 27	Luzerne
Hetrick, A. W.	Beavertown	Snyder
Hetrick, J. Frank	Beavertown	Snyder

* Life Member.

Name	Address	County
Hicks, William	Honesdale	Wayne
Higgins, W. A.	Dallas, R. D.	Luzerne
Hildebrandt, John A.	Dallas, R. D. 2	Luzerne
Hildebrandt, John E.	Dallas, R. D. 2	Luzerne
Hile, Anthony	Curwensville	Clearfield
Hileman, W. Carl	New Castle, R. D. 3	Lawrence
*Hill, William D.	North East	Erie
Hinnershitz, C. Walter	1255 Buttonwood St., Reading	Berks
Hoffman, D. M.	Biglerville	Adams
Hoffman, H. L.	Butler, Star Route	Lawrence
Holtzapple, Frank P.	Selinsgrove, R. 2	Snyder
Hood, T. C.	Saltsburg, R. 1	Indiana
*Hoopes, Wilmer W.	West Chester	Ches.-Del.
Hootman, H. D., Secy., Mich. State Horticultural Society	East Lansing, Michigan	
Hoover Bros.	New Wilmington	Lawrence
Hoover, Wm.	Blacklick, R. D., Box 116	Indiana
Horn, W. H.	Chambersburg, R. 10	Franklin
Hornberger, J. W.	Denver, R. D. 1	Lancaster
Horner, Winfield G.	Gettysburg, R. D.	Adams
*Horst, J. Morris	Lebanon, R. 3	Lebanon
*Hostetler, Abram	Johnstown, R. D. 3	Cambria
Hostetter, C. N.	Washington Boro	Lancaster
Hostetter, Dr. J. E.	Gap, R. D. 1	Lancaster
Houck, Dallas	New Castle	Lawrence
Houser, Jacob R.	Lampeter	Lancaster
Howard, P. H.	Dover, R. D. 1	York
Howatt, Mrs. Maude	Coopersburg, R. 2	Lehigh
Hubbard, E. Stuart	Poughkeepsie, N. Y.	
Huber, C. H.	Gettysburg	Adams
Huber, Herman	Narrowsburg, N. Y., R. 1	Wayne
Huber, Edwin B.	232 S. Main St., Chambersburg	Franklin
*Huey, S. R.	New Castle, R. D. 3	Lawrence
Hughes, J. N.	Mercer, R. D. 1	Mercer
Hunt, N. M.	New Castle, R. 4	Lawrence
Hykes, E. S.	York, R. D. 5	York
Ide, Silas C.	Sweet Valley, R. 1	Luzerne
Imswiler, John S.	West Chester	Chester
Ingham, M. M.	New Castle, R. 5	Lawrence
Irvin, W. M.	Marion Center	Indiana
Jackson, C. E. Co.	Chambersburg	Franklin
James, D. M.	Bureau of Markets, Harrisburg	
James, J. E.	Box 143, Hagerstown, Md.	
Jefferson, Thomas H.	Wycombe	Bucks
Jersey Package Co. Inc.	Bridgeton, N. J.	
Johnson, John	New Wilmington	Lawrence
Johnston, R. S.	New Wilmington, R. D. 1	Lawrence
Johnston, Rolland G.	Hereford	Berks
Johnston, M. E.	Connoquenessing	Butler
*Johnston, Mrs. F. C.	Dallas	Luzerne
Joseph, W. H. & Son	119 Fulton St., New York City	
Karns, J. H.	Chambersburg	Franklin
Kauffman, A. L.	Bird-in-Hand, R. D. 1	Lancaster
Kauffman, C. B.	Bird-in-Hand	Lancaster
Kauffman, J. B.	York, R. D. 7	York
Kauffman, C. E.	Manchester, R. 1	York
Keil, A. T.	Mars, R. 1	Allegheny
Keim, Milton W.	Boyertown, R. 2	Berks

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Name	Address	County
*Keller, Paul J.	Alder Run Orchards, Tyrone	Blair
Kellow, George H.	Scranton, R. 1	Lackawanna
Kendig, Dr. J. S.	Salunga	Lancaster
Kerchner, Harvey T.	Lenhartsville	Berks
*Kessler, George W.	Tyrone	Blair
Ketner, Jacob B.	Wernersville	Berks
Kibler, T. F.	North Girard	Erie
*Kister, U. G.	Etters	York
Klein, Jack	145 Dock St., Philadelphia	Lancaster
Kleppinger, B. M.	Coopersburg, R. D. 2	Lehigh
Klipple, J. W.	Clarks Summit, R. D. 2	Lackawanna
Knappenberger, Thomas	Zionsville, R. D. 1	Lehigh
Knelly, Willis	Sugarloaf R. 1	Luzerne
Knouse, M. E.	Peach Glen	Adams
Koch, C. H.	McKeansburg	Schuylkill
*Koehler, Paulus E.	826 Washington Ave., Monaca	Beaver
Kovacs, Rudolph	Orefield	Lehigh
Krebs, H. B.	Mercersburg	Franklin
Krick, Charles E.	Reamstown	Lancaster
Kuhns, Victor	Allentown R. 3	Lehigh
Kyle, B. Wm.	Zionsville	Lehigh
Lacoe, Nelson	Clarks Summit, R. D.	Lackawanna
*Landis, D. M.	Lancaster, R. 7	Lancaster
Landis, Harry	Girard	Erie
Landseidel, L. A. & Son	Clarks Summit, R. 2	Lackawanna
Lapp, John F.	Ronks, R. 1	Lancaster
Latshaw, J. E.	Marion	Franklin
Lau, Rev. I. M.	715 Manor St., York	York
Lau, L. B.	East Berlin, R. 2	York
Lau, L. E.	East Berlin, R. D. 2	York
Laudenslager, Martin	Orefield, R. D. 1	Lehigh
LeBoutillier, Chester	Wayne	Ches.-Del.
Lehman, Elias	York No. 5	York
Lehman, George	Hellam, R. 1	York
Lehman, S. S.	Girard	Erie
Lengle, Paul H.	Pine Grove	Schuylkill
Leiberknecht, M. F.	Mt. Wolf, No. 1	York
Leibhart, Lloyd	Wrightsville, R. 1	York
Leibhart, Samuel H.	Wrightsville, R. 1	York
Lemmon, D. R.	North Girard	Erie
*Leonard, F. E.	Carlisle, R. 1	Cumberland
Lepole, Walter	Akron	Lancaster
Leslie, Lee C.	2732 N. 45th St., Philadelphia	
Lewis, Nelson H.	Pittston, R. 1	Luzerne
Lewis, Norman	Pittston, R. 1	Luzerne
Lewis, S. V.	Wyoming, R. 1	Luzerne
Lightner, E. S.	York, R. D. 11	York
Linde, J. Eric	Orefield, R. 1	Lehigh
Linville, Arthur S.	Media, R. 2	Delaware
Livingood, Mrs. Stella	Robesonia	Berks
Long, D. Edward	Fayetteville	Franklin
Long, J. C.	340 E. Liberty St., Lancaster	Lancaster
*Loop, A. I.	North East	Erie
Loop, H. S.	North East, R. 2	Erie
Loose, H. H.	Menges Mills	York
*Lord, John	Wyoming, R. 1	Luzerne
Lothrop, C. L.	Chipman Chemical Co., Bound Brook, N. J.	

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Name	Address	County
Lott, R. C.	Gettysburg	Adams
Lott, William M.	Gardners	Adams
Loucks, Walter	454 Linden St., York	York
Lowry, C. W.	Mount Alto	Franklin
Lucabaugh, J. W.	Hanover, R. 6	Adams
Luce, D. H.	Harborcreek	Erie
Ludt, John F.	Telegraph Bldg, Harrisburg	
Lusk, Fred F.	New Wilmington	Lawrence
Lutz, H. W.	Carroll, Ohio	
McDannel, Edgar C.	Biglerville	Adams
*McClelland, J. B.	Canonsburg	Washington
McClelland, W. C.	Mercer, R. D. 6	Mercer
McClure Bros.	Quarryville	Lancaster
McClure, Frank	New Castle, R. D. 1	Lawrence
McCormick, C. M.	Knox Ave., New Castle	Lawrence
*McCormick, James	Harrisburg	Dauphin
McDonald, R. C.	Shippensburg, R. 3	Franklin
McElhaney, Jos.	Franklin, R. D.	Venango
McElholt, Ray	Home	Indiana
*McFarland, J. Horace	Harrisburg	Dauphin
McFarland, Rev. K. W.	New Wilmington	Lawrence
McGinnis, C. R.	523 Oley St., Reading	Berks
*McGeorge, Mrs. Katherine L.	Orrtanna	Adams
McHenry, Clarence	Indiana	Indiana
McIlvaine, J. S.	Fayetteville	Franklin
*McKee, J. M.	c/o Dairyman Corp. Sale, Century Bldg, Pittsburgh	
McKeehan, James	Honesdale	Wayne
McKibben, E. S.	Fayetteville	Franklin
*MacNeal, William H.	Parkesburg	Chester
McNitt Fruit Farm	Milroy	Mifflin
McPherson Bros.	Bridgeton	York
McPherson, Roy P., Secy., N. Y. State Horticultural Society	LeRoy, N. Y.	
McWhorter, O. T., Secy.-Treas., Oregon State Horticultural Society	Corvallis, Oregon	
Mack, J. S.	Brush Valley	Indiana
Mackey, Earl	Orefield	Lehigh
Maloney Bros. Nursery Co.	Dansville, N. Y.	
Marcks, Miss Verna	401 Chestnut St., Emaus	Lehigh
Markey, Miss Henrietta	York, R. 2	York
Martin, Wade	Indiana	Indiana
Marvil Package Co.	Laurel, Delaware	
Matthews, W. H.	Box 313, Salem, Ohio	Lawrence
Mattern, Jos. C.	310 Newry St., Hollidaysburg	Blair
Maurer, J. Edward	Selinsgrove, R. 1	Snyder
Mauger, Maurice	Boyertown, R. 2	Berks
Mayer, L. E.	Boyertown	Berks
*Mayer, Guy S.	Willow Street, R. 1	Lancaster
Mecartney, J. L.	State College	Centre
Mechling, Edward A.	Moorestown, N. J.	
*Meehan, S. Mendelson	Newton Square	Chester
Meister, Kenneth G.	Chambersburg, R. 6	Franklin
Mellinger, Jacob D.	Lancaster, R. 8	Lancaster
Mellor, Wm.	Wayne	Delaware
Merring, Guy	Cortez	Wayne

* Life Member.

Name	Address	County
Metzler, Harry R.	Paradise	Lancaster
Miles, H. C. C., Secy., Conn. Pomological Society	Milford, Conn.	
Millard, H. E.	Annville	Lebanon
*Miller, Amos	Hanover, R. 4	York
Miller, Blaine	Indiana, R. 4	Indiana
Miller, C. Clayton	Marion	Franklin
Miller, C. E.	820 Mulberry Ave., Hagerstown, Md.	
Miller, Carroll R., Secy., W. Va. Horticultural Society	Martinsburg, W. Va.	
Miller, Crist	Marion	Franklin
Miller, Clement R.	Orefield	Lehigh
Miller, Frank	Lake Ariel	Wayne
Miller, Frank M.	Waynesboro, R. 4	Franklin
Miller, Harvey	Loganville	York
Miller, H. W.	Paw Paw, W. Va.	
Miller, J. J.	Wood Refrigerating Co., 1539 Penn Ave., Pittsburgh	Allegheny
Miller, John W.	Ephrata, R. 2	Lancaster
Minnich, C. S.	Reading, R. 2	Berks
Misiewicz, Ben	409 E. Washington St., Nanticoke	Luzerne
Mitchell, E. B.	Harrisburg, R. D. 2	Dauphin
Mitterling, John T.	Mt. Pleasant Mills	Snyder
Mohring, F. H.	North Girard	Erie
Mohr, Frank J.	Fogelsville	Lehigh
Mohrman, Dick	Narrowburg, N. Y.	Wayne
*Moon, Henry T.	Morrisville	Bucks
Moore, M. A.	Lititz	Lancaster
Moorhead, Douglas	North East	Erie
Morris, Robert	Erie, R. D. 2	Erie
Morse, Carl	New Wilmington	Lawrence
Morton, M. C.	Davison Chemical Corp., Rouse Bldg., Baltimore, Md.	
Moss, Harvey	Dallas, R. D. 4	Luzerne
Mount Breeze Orchard Co.	Fayetteville, R. 1	Franklin
Mowery, Harold F.	12 E. Coover St., Mechanicsburg	Franklin
Mowery, N. E.	40 W. Main St., Mechanicsburg	Cumberland
Moyer, Lee	Freeburg	Snyder
Murray, George R.	298 Philadelphia Ave., Chambersburg	Franklin
Murphy, P. J.	White Haven	Luzerne
Murray, Edward A.	Punxsutawney, R. D.	Indiana
Murtoff, C. J.	Gardners	Adams
Musselman, C. H. Co.	Biglerville	Adams
Musselman, I. Z.	Orrtanna	Adams
Musser, Irvin W.	Mount Joy	Lancaster
Musser, W. E.	New Bethlehem, R. 3	Clarion
*Myers, Levi M.	Bowmansdale, R. 1	York
Myer, Reuben	Lititz, R. 5	Lancaster
National Sulphur Co. Inc.	420 Lexington Ave., New York City	
Nece, H. J.	Fairview	Erie
Neely, P. A.	Mercersburg, R. 1	Franklin

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Name	Address	County
Neidel, John Jr.	Oil City, R. 1	Venango
Neiman, Otto	Dover, R. D. 3	York
Nelson, Corbett D.	711 Evesham Ave., Baltimore, Md.	Franklin
Newman, H. W.	New Castle, R. D. 4	Lawrence
Newman, H. H.	Fayetteville	Franklin
Newton, O. A. & Son Co.	Bridgeville, Del.	
Niagara Sprayer & Chemical Co.	Middleport, N. Y.	
Nibert, Wm.	Indiana, R. D.	Indiana
Nicodemus, Ed	Waynesboro	Franklin
Niles, Ben E., Secy., Ky. State Horticultural Society	Henderson, Ky.	
Nitchman, C. H.	Aspers	Adams
Nolt, Harrison S.	Columbia	Lancaster
Northrup, H. J.	Dalton	Lackawanna
Noss, J. A.	New Castle, R. 5	Lawrence
Ober, Dr. H. K.	College Ave., Elizabethtown	Lancaster
*O'Connor, Haldeman	13 N. Front St., Harrisburg	Dauphin
Omwake & Oliver	Greencastle	Franklin
Owens, Henry K.	25 N. Russell St., York	
Oyler, George	McKnightstown	Adams
Oyler, William	Arendtsville	Adams
Oyler, H. J.	Gettysburg, R. D.	Adams
*Page, C. M.	Etters	York
Palmer, Aaron H.	Lancaster Co. Almshouse, Lancaster	Lancaster
*Pannebaker, William M.	Virgilina, Va.	
Panovec, Victor	Easton, R. D. 2	Northampton
Paradise Orchard	618 W. Market St., York	York
Parker, Captain H. B.	261 Newbury St., Boston, Mass..	
Parker, R. C.	333 Morris Ave., Rockville Center, N. Y.	
Paschal, John	Kennett Square	Chester
Paschke, D. C.	North East	Erie
Passmore, Norman S.	Glen Mills, R. D. 1	Delaware
Passmore, S. S.	Mendenhall	Ches.-Del.
Patterson, James W.	Apollo	Indiana
Paxson, Edw. M.	Lumberville, R. D.	Bucks
Paxson, Samuel L.	Doylestown, R. D.	
Pence Fruit Farm	Star Route, New Bethlehem	Clarion
Pennock, Geo. S.	165 W. Essex Ave., Lansdowne	Ches.-Del.
Pennypacker Co.	Emaus	Lehigh
Peters, C. W.	Biglerville	Adams
Peters, A. D.	Scotland	Franklin
Peters, Jos. E.	Fayetteville	Franklin
Petton, S. B.	Erie, R. D. 1	Erie
Pheil, Clifton	St. Thomas	Franklin
Pinckney, Will	East Springfield	Erie
Poff, Leroy	Hummelstown, R. D. 2	Dauphin
Poor, D. W.	Narrowsburg, N. Y.	Wayne
Porter, H. K. Inc.	6 Ashland St., Everett, Mass.	
Powers, R. A.	Hartwood Farm, Sharpsburg	Allegheny
Prather, E. M.	Dept. of Horticulture, Nashville, Tenn.	
*Pratt, B. G.	Pratt Chemical Co., 50 Church St. N. Y. City	

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Name	Address	County
Pratt, Lee	Chambersburg	Franklin
Prinn, J. K.	Oak Lane, Philadelphia	
Pugh, George C.	Chambersburg, R. 3	Franklin
Quigle, Harvey	Bendersville	Adams
Quigley, Ford F.	Chagrin Falls, Ohio	
Raffensberger, Charles	Biglerville	Adams
Raffensberger, H. B.	Arendtsville	Adams
Rahauser, Joseph	Greencastle	Franklin
Raine, J. Tom	Fairview	Erie
*Rankin, Charles C.	The Kenilworth, Alden Park, Germantown	
Rapp, Dr. Ira M.	235 N. 6th St., Reading	Berks
Raynor Bros.	Salisbury, Md.	
Reckard, R. W.	Brookline	Ches.-Del.
Reist, Clarence J.	Paragon Nut & Fruit Farm, Landisville	Lancaster
Reist, Henry G.	1166 Avon Road, Schenectady, New York	Lancaster
Reiter, F. G.	Mars	Allegheny
Reiter, Raymond	Mars	Allegheny
Renfrew, R. N.	Fayetteville, R. 1	Franklin
Rhine, H. L.	McClure	Snyder
Rice, Daniel	Elliottsburg	Perry
Rice, John	Penn Run, R. D.	Indiana
Richards, Frank E.	Clarks Summit, R. 2	Lackawanna
Richardson, W. T. & Son	Whiteford, Md.	York
Rick, John M.	Ellwood City, R. 1	Lawrence
Rick, Charles M.	431 Windsor St., Reading	Berks
*Rick, John	West Leesport, R. 1	Berks
Riley, Raymond G.	North Girard	Erie
*Rinehart, E. S.	Mercersburg	Franklin
Rinn, J. Cloid	Indiana	Indiana
Ritter, Arthur	Allentown, R. 3	Lehigh
Ritter, Astor	Allentown, R. 3	Lehigh
Ritter, Ernest	Winfield, R. D.	Snyder
Rittenhouse, Dr. J. S.	Lorane	Berks
Rittenhouse, S. B.	Lorane	Berks
*Roberts, Horace	Moorestown, N. J.	
Roberts, J. Earle	220 Dock St., Philadelphia	Philadelphia
Robinson, Walter D.	Elliottsburg, Box 14	Perry
*Rohde, William	Johnstown	Cambria
Rohrer, Geo. H.	Dryville	Berks
Romig Brothers	Downingtown	Chester
Romig, E. B.	McKnightstown	Adams
Root, J. W.	Manheim, R. D. 1	Lancaster
Rose, C. S.	Lititz	Lancaster
Rosensteel, L. C.	Edri	Indiana
Ruhl, Dr. H. F.	Box 236, Manheim	Lancaster
*Runk, J. A.	Huntingdon	Huntingdon
Russell, Harry C.	Castle Shannon	Allegheny
Ruth, Charles	422 Ridge St., Emaus	Lehigh
Rutt, B. T.	Hummelstown, R. 2	Dauphin
Rutter, Mrs. Walter R.	New Holland, R. 2	Lancaster
Sachs, Edward H.	Biglerville	Adams
Sahli, Elmer	Gibsonia	Allegheny
Salsgiver, Andrew	Indiana, R. 7	Indiana
Sankey, H. S.	New Wilmington, R. 1	Lawrence

* Life Member.

Name	Address	County
Sanford, Donald	Dow Chemical Co., Midland, Michigan	
Satterthwaite, Lewis P.	Newtown	Bucks
*Satterthwaite, Frederick G.	Yardley	Bucks
Schantz, H. A.	538 Hamilton St., Allentown	Lehigh
Schieferstein, William	Leesport	Berks
Schoelkopf, Carl	Wernersville, R. 3	Berks
Scholl, W. J.	Barto	Berks
Schoonover, W. E.	Dallas, R. D. 3	Luzerne
Schreiber, Harry F.	Zionsville	Lehigh
Schantz, L. M.	Orefield, R. D. 1	Lehigh
Schrope, John	Hegins	Schuylkill
Schuldt, J. Carlton	Elizabethtown	Lancaster
Schultz, August	Wyoming, R. 1	Luzerne
Schultz, Chester K.	Barto	Berks
Schwitters, H. E. & Son	375 Washington St., New York City	
Seachman, George E.	Windsor, R. D. 1	York
Seaman, George	Honesdale	Wayne
*Searle, Alonza T.	Honesdale	Wayne
Seitz, John B.	Rohrerstown	Lancaster
*Settlemeyer, C. T.	Wilmore, R. D.	Cambria
Shaffer, Harry	Penn Run	Indiana
Shaffer, Albert	Cherry Tree	Indiana
Shaffer Bros.	Gravity	Wayne
*Shenk, H. L.	Lancaster, R. 7	Lancaster
Shattuck, J. H.	Erie, R. D. 6	Erie
Shatzer, P. R.	1307 Scotland Ave., Chambersburg	Franklin
Shaw, R. C.	Stewartstown	York
Shearer, Walter J.	Vinemont	Berks
Sheadle, Misses Adele & Lydia	Jersey Shore, R. D. 4	Lycoming
Shearer, J. W.	Vinemont	Berks
Sheble, Earl	Hamburg, R. 2	Berks
Shenk, D. W.	Lancaster, R. 7	Lancaster
Shenot, C. P.	Wexford	Allegheny
Shenot, Edward	Wexford	Allegheny
Sherwood, Earle D.	517 Rossiter Ave., Baltimore, Md.	
Shoemaker, Lewis	Catasauqua	Lehigh
Showers, Lloyd	Bethel	Berks
Shriver, George	Bendersville	Adams
Sidler, Anton	York, R. D. 9	York
Siegfried, A. H.	Selinsgrove	Snyder
Sierer, Clark	Mt. Pleasant Mills	Snyder
Sillman, L. E.	547 Frederick St., Hagerstown, Md.	Franklin
Silmo Chemical Co.	Vineland, N. J.	
Silvis, A. M.	Shelocta, R. 2	Indiana
Simmons, Daniel	Pittsburgh (10), R. D. 6	Allegheny
Simmons, S. L.	Pittsburgh (10), R. D. 6	Allegheny
Skinner, H. W.	Chambersburg	Franklin
Slade, J. E.	2303 Allen St., Allentown	Lehigh
Slade, Martin	Biglerville	Adams
Slaybaugh, Glen	Gettysburg, R. 5	Adams
Smedley, S. L. Jr.	Newtown Square	Delaware
*Smedley, S. L. Sr.	Newtown Square	Delaware

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Name	Address	County
Smith, A. Woodward	Blairsville, Box 75	Indiana
Smith, B. E.	Pittston, R. 1	Luzerne
Smith, Clemon	Nescopeck, R. 1	Luzerne
Smith, G. C.	North East	Erie
Smith, James E.	Four Oaks Farm, Bethlehem, R. 4	Lehigh
Smith, G. E.	Bethlehem, R. 4	Lehigh
Smith, Lawrence J.	Box 222, South River, N. J.	
Smith, Leonard R.	Garden St., Mt. Holly, N. J.	
Smith, Roland M.	Marion Center, R. 2	Indiana
Smith, S. A.	Yoe	York
Smith, W. A.	Trucksville, Box 36	Luzerne
Smith, Wm.	Berwick, R. D. 1	Luzerne
Smith, Wm. H.	144 Front St., Catasauqua	Lehigh
Smith, Wm. M.	Orefield, R. D. 1	Lehigh
Smith, W. & T. Co.	Geneva, N. Y.	
Snavely, The Misses	Westmont Fruit Farm, R. 5, Lebanon	Lebanon
*Snavely, H. H.	Willow Street	Lancaster
Snyder, Fry & Rick	Reading, R. D. 2	Berks
Snyder, C. B.	Ephrata, R. 1	Lancaster
Snyder, Elmer R.	Florin	Lancaster
Snyder, Fred	Avonmore, R. D. 1	Indiana
Snyder, Geo.	Dallas, R. 3	Luzerne
Snyder, John B.	Yoe	York
Snyder, Dr. J. C.	Washington State College, Pullman, Wash.	
Snyder, Simon R.	Ephrata, R. 1	Lancaster
Spangenberg, M. T.	Waymart	Wayne
Soergel, Alfred	Wexford	Allegheny
Spessard, H. W.	Chambersburg	Franklin
Spiegelmyer, S. W.	McClure	Snyder
Sprankle, Kemp	Punxsutawney, R. 1	Indiana
Stahle, Carl	Manchester, R. 1	York
Stark Bros. Nurseries & Orchard Co.	Louisiana, Missouri	
Starry, Norman D.	York Springs	Adams
Stauffer, T. H.	Lititz, R. D. 1	Lancaster
*Stear, J. R.	Saltsburg	Indiana
Steele, Emory	Plymouth, R. D.	Luzerne
Steele, Harold	114 W. Wesley St., Jackson, Mich.	
Stegner, Chas. B.	Titusville	Venango
Stein, Geo. E. & Son	Wrightsville, R. D. 1	York
Stein, Henry	Woodville	Allegheny
Steininger, E. B.	Troxelville	Snyder
Stitt, L. P.	Blairsville, R. D. 2	Indiana
Stone, Leon	Dalton, R. 3	Lackawanna
Stonebraker, H. W.	Indiana, R. D. 7	Indiana
Stoner, James	Lititz, R. 5	Lancaster
Stoneroad, S. A.	New Providence	Lancaster
Stoner, Harry S.	Orrtanna	Adams
Stoudt, Mrs. Lillie K.	Hamburg, R. 1	Berks
Stover, Jacob E.	Springwood Farms, York, R. D. 2	York
*Strasbaugh, E. F.	Orrtanna	Adams
Strasbaugh, S. E.	Guernsey	Adams
Straub, W. D.	Middleburg, R. 3	Snyder

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Name	Address	County
Strawbridge, N. G.	Fawn Grove	York
Strawser, A. A.	Mt. Pleasant Mills	Snyder
Strickler, D. A.	Hagerstown, Md.	Adams
Strong, T. M.	Blairsville, R. D. 1	Indiana
Strype, Fred C.	103 Lafayette St., New York City	
Staufflet, Fred	Fogelsville	Lehigh
Sutton, C. D.	Franklin	Venango
Sutliff, Dana	Shickshinny, R. D.	Luzerne
*Swank, Luke H.	Swank Hardware Co., Johnstown	Cambria
Swartz, D. H.	Clymer, R. D. 1	Indiana
Swartz, Emma	Spring Grove	York
Syling, E. S.	New Castle, R. 7	Lawrence
Tarbert, D. F.	Dallastown, R. D. 1	York
Tate, S. C.	Erie, R. D. 5	Erie
Taylor & Co.	West Chester, R. D.	Chester
Taylor, Chas.	Biglerville	Adams
Taylor, H. E.	Biglerville, R. 1	Adams
*Taylor, Ralph S.	West Chester, R. D.	Chester
Thayer, Paul	Carlisle, R. D. 6	Cumberland
*Thomas, Charles L.	King of Prussia	Montgomery
*Thomas, Edwin W.	King of Prussia	Montgomery
Thomas, W. W.	150 Bayway, Elizabeth, N. J.	
Thomford, C. F. B.	Kennett Square	Ches.-Del.
Thompson, Ivan	Clarks Summit	Lackawanna
Thompson, Maurice	Clarks Summit, R. D.	Lackawanna
Titus Nursery Co.	Waynesboro, Va.	
Townsend, E. W. & Sons	Salisbury, Md.	
Trefethern, Winthrop N.	Elizabeth Farms, Lititz	Lancaster
Trexler, T. A.	Selinsgrove, R. D.	Northumberl'd
Trimble, Edward	Indiana, R. D.	Indiana
Turner, Frank	Franklin, R. D.	Venango
Turrell, Elmore	Noxen	Wyoming
*Tyler, W. D.	Dante, Va.	
*Tyson, Chester J.	Gardners	Adams
Tyson, Chester J. Jr.	Gardners	Adams
Tyson, Donald C.	Gardners	Adams
*Tyson, Edwin C.	Flora Dale	Adams
*Tyson, William C.	Flora Dale	Adams
Van Riper, Frederick E.	Allendale, N. J.	
Vierheller, A. F.	Md. State Hort. Society, College Park, Md.	
Vincent, C. L.	Washington Hort. Society, Pullman, Wash.	
Vite, J. C.	Rossiter, R. 1	Indiana
Vogel, E. H.	Lancaster, Box 35	Lancaster
Vosler, E. B.	Hunlock Creek, R. D.	Luzerne
Voss, Walter	North Girard	Erie
Wagener, D. D. & Co.	Easton, R. D. 2	Northampton
Wagner, Charles E.	McClure	Snyder
Wagner, Harvey	232 Main St., Emaus	Lehigh
Wagner, R. K.	New Florence	Indiana
Wagonhurst, Anna	Bechtelsville, R. D.	Berks
Walker, S. B.	Coplay	Lehigh
Walker, William	New Castle, R. 1	Lawrence
Walter, Martin	Biglerville	Adams
*Walton, Robert J.	Hummelstown	Dauphin

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Ward, M. R.	East Springfield	Erie
Warden, Claude	Shavertown	Luzerne
Watson, R. L.	Connoquenessing	Butler
Way, D. H.	Port Matilda	Centre
Weaver, E. A.	Fayetteville, R. 1	Franklin
Weaver, J. B.	Terre Hill	Lancaster
*Weaver, Abram	Scalp Level	Somerset
Weaver, Wm. S.	Macungie	Lehigh
Weber, Nelson	Orefield	Lehigh
*Weigel, H. M.	Aspers	Adams
*Weimer, E. A.	Lebanon	Lebanon
Weinberger, J. H.	Zionsville	Lehigh
Welshans, D. D.	Jersey Shore, R. D. 3	Lycoming
Welshans, M. O.	Jersey Shore, R. D. 3	Lycoming
Welty, S. N.	Hellam, R. 1	York
Wenger, G. P.	402 S. State St., Ephrata	Lancaster
Wernig, Charles M.	York, R. D. 2	York
Wertsch, Edwin	Stevens, R. 2	Lancaster
*Wertz, D. Maurice	Waynesboro	Franklin
*Westrick, F. A.	Patton, R. 2	Cambria
Wheeler, C. B.	Hunlocks Creek, R. 2	Luzerne
*Whisler, Edgar	Etters, R. 1	York
Whitcomb, Paul	York, R. D. 4	York
White, Corry	Dallas, R. 3	Luzerne
White, J. G.	Boyertown	Lehigh
White, J. W.	Indiana	Indiana
White, Mrs. L. E.	Jermyn	Luzerne
Whiting, John	New Bedford	Lawrence
Wickersham, C. T.	East Springfield	Erie
Widders, J. B.	Lancaster, R. D. 3	Lancaster
Wieland, Carl	Box 145, Paradise	Lancaster
Wierman, C. H.	Bendersville	Adams
Wilhelm, L. J.	Sharon, R. D. 2	Mercer
Williams, Luther S.	Indiana, R. D. 1	Indiana
Wilson, Charles S.	Oliver Farm Equipment Co., 58 W. Keller St., Mechanicsburg	
Wills, V. A.	Supplee-Wills-Jones Milk Co., 1515 N. 26th St., Phila.	
Wilson, David	Bridgeton	York
Wilson Farm	Wilkinsburg, R. 1	Allegheny
Wilson, H. W. Co.	950 University Ave., New York	
Wilson, J. G.	Aspers	Adams
Winter, J. D.	Minnesota Fruit Growers' Assn., 786 Eustis St., St. Paul, Minn.	
Winner, G. B.	American Cyanamid Co., 30 Rockefeller Plaza, New York City	
Wink, Edwin T.	Lenhartsville, R. D. 1	Berks
Winter, M. L.	Hellam, R. D. 1	York
Wise, Harvey	Commodore, R. D.	Indiana
Wishard, W. H.	132 W. Main St., Waynesboro	Franklin
*Wister, John C.	Clarkson & Wister Sts., Germantown	Philadelphia
*Witherow, R. T.	Punxsutawney	Jefferson
Witman, John	Box 316, Reading	Berks
Wolfe, Charles D.	U. B. Quincy Orphanage, Quincy	Franklin

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Wolfe, Joseph	Allentown, R. D. 1	Lehigh
Wolfe, P.	46 Oxford St., Wilkes Barre	Luzerne
Wolfe, Walter	Dallas, R. D. 2	Luzerne
Wolff, F. B.	Lima	Delaware
Wolfinger, Don L.	Chambersburg, R. 1	Franklin
Worley, Edwin	Mohnton	Berks
Worley's Nursery	York Springs, R. D. 1	Adams
Worthington, Harvey C.	West Chester, R. D. 2	Chester
Worthington, H. R.	West Chester	Chester
Wotring, Oscar A.	Orefield	Lehigh
Wotring, Dewey	Schnecksville, R. 1	Lehigh
Wright, Everett, Secy., Indiana Hort. Society	Lafayette, Indiana	
Yerger, C. R.	Apollo, R. D. 3	Armstrong
Yiengst, E. W.	Gardners	Adams
Yoat, A. J.	Punxsutawney, R. D. 3	Indiana
Yocum, A. H.	344 S. 5th St., Reading	Berks
Yoder, Ira L.	Middleburg	Snyder
Yohe, George S.	Spring Grove	York
Yohe, Rev. Jay W.	Fayetteville	Franklin
Young, A. T.	North East, R. D. 3	Erie
Young, Junius	Narrowsburg, N. Y.	Wayne
Young, Miles	Narrowsburg, N. Y.	Wayne
Young, R. C.	Chambersburg, R. 10	Franklin
*Youngs, L. G.	North East	Erie
Zarfoss, J. W.	Elizabethtown	Lancaster
Zeigler, E. Calvin	529 W. Market St., York	York
Zeigler, J. A. C.	York, R. D. 8	York
Zook, Amos F.	Lancaster, R. D. 5	Lancaster
Zook, I. F.	Curryville	Blair

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