PROCEEDINGS

of the

AMERICAN POMOLOGICAL SOCIETY

Council Bluffs, Iowa
November 15, 16 and 17, 1922

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THE HOMESTEAD PRINTING CO., DES MOINES

PROCLAMATION

OF THE

Thirty-ninth Convention of the American Pomological Society

1848-1922

In accordance with the action of the Executive Committee in determining the place and date and in pursuance of long-established custom, it is hereby declared that the thirty-ninth convention and exhibition of the American Pomological Society will be held in Council Bluffs, Iowa, in conjunction with the Mid-West Horticultural Exposition and in co-operation with the Iowa State Horticultural Society, beginning in the forenoon of Wednesday, November 15th and continuing to the 17th, 1922. All friends of fruit-growing, whether amateur or commercial, whether their areas are small or large, are cordially invited to be present to hear the discussions and to partake in them, to view the exhibits, and to join in the fellowship; and likewise all nurserymen, commercial men, manufacturers, whose enterprises touch the fruit-growing interests; and equally all persons in colleges, experiment stations, government departments, and elsewhere whose work brings them into relation with the growing, marketing or utilization of fruits. The general public is welcomed to the meetings. The convention should be a yearly clearing-house of fruit-growing inspiration, information, and development. To further this work, we request that commercial firms, institutions, and horticultural societies send delegates.

Specimens of good fruits, new and old, are solicited for the exhibition tables; as also containers, implements, machines and any mechanical devices of interest to fruit-growers, and also nursery-stock, books, materials, and whatever else may contribute to the interest of the convention.

The American Pomological Society covers the national and international fields. It does not interfere with the work of State and local societies. It is concerned primarily with questions of broad policy affecting the growing and disposal of fruits of all kinds, and with the enlightenment of the public to the uses of fruits and the blessings in growing them. It is an educational body. To this end, we look forward to a large and varied attendance. We hereby formally announce the event to our membership.

L. H. Bailey, *President.*

R. B. Cruickshank, *Secretary-Treasurer.*
October 16, 1922.

THE AMERICAN POMOLOGICAL SOCIETY

In joint session with the Iowa State Horticultural Society, the American Pomological Society held its thirty-ninth convention at Council Bluffs, Iowa, November 15, 16 and 17, 1922. Vice-President Paul C. Stark, Louisiana, Missouri, presided as chairman.

ADDRESS OF WELCOME

W. P. Dawson, Aurelia, Iowa, President Iowa State Horticultural Society

Gentlemen of the American Pomological Society: The Iowa State Horticultural Society extends a cordial welcome to you, the oldest fruit organization in America.

The Iowa State Horticultural Society, with its affiliated societies, has a membership of about three thousand. This includes fruit growers, vegetable growers, florists, nurserymen, landscape architects and beekeepers. All these societies extend to you of the American Pomological Society greetings and hearty welcome. It is not going too far to assure you that this midwestern region—Iowa and her sister states—unite wholeheartedly in this welcome.

There are many reasons why we are pleased that the executive committee decided to hold the Thirty-ninth convention of the American Pomological Society here: This middle west is perhaps the greatest general agricultural region in the world. Its people have passed the pioneering stage and are now in the midst of the development of convenient modern homes and attractive and congenial home surroundings. They are beginning to realize that with proper home environment there can be no better place to grow up and live than in a home in the mid-west. In this constructive work we need the advice and help of those who have already met and solved similar problems. You, learned gentlemen of the American Pomological Society, by your presence, your experience and knowledge of fruit and allied lines, will help greatly in encouraging and advising in proper planting, care and management of their orchards and small fruit gardens. They are in need of instruction in sorting, grading, packing, and especially in the marketing of their fruits. You, having passed through this stage of development and solved its problems, will realize that we may gain much from you and we, figuratively, "sit at your feet" to receive information and learn wisdom.

Iowa and the mid-west are known nationally as "the place where the tall corn grows," but those of us who know the possibilities of the soil and climate of this region and the temper of its people will prove to you that it also is "where the juicy, red apple" can be made to grow, and where such homey homes can be made that our sons and daughters will grow up to good citizenship in them, leave them with reluctance and return to them with pleasure and contentment.

Gentlemen, we believe your presence here will aid and encourage us in this. And again we welcome you.

TWO SIDES OF POMOLOGY

L. H. Bailey, President, Ithaca, New York

On the occasion of its thirty-ninth convention and in its seventy-fourth year, the American Pomological Society faces new responsibilities and goes into its enlarging work with assurance and determination. The plans of reorganization have taken form. The society is moving in harmony with the expanded vision of those who see the fruit-growing interests of the continent in a bold way, and yet it does not forget the humble growers—the amateurs and the others—to whom a little enterprise lies as close to the heart as does the great activity of masterful men. These are the two coordinate sides of the works of the American Pomological Society—to keep in touch with every commercial movement and to aid it, and at the same time to stimulate the growing of fruits at the homes of an increasing number of our people. In proportion as the society is able to cover these two sides of its field will it have an assured success.

These two fields of effort are not conflicting. A common motive underlies the whole range of pomology—to produce excellent fruits. The growing of fruits at the home does not limit the sales of fruits by the commercial grower. Rather does it stimulate such sales, for it develops a habit of fruit consumption; and rarely can the home of small area grow enough for all its needs. The more publicity we develop on the subject of fruit and its consumption, the greater will be the demand for it and the more satisfactory its movement. There must always remain vast numbers of the population who can never grow fruit under any conditions; for them other processes of education are to be made available. The sensibilities are greatly developed by the use of fruit in the home—the beauty and fragrance of the product, the form and color, the eating qualities that stimulate the discriminating faculties rather than merely to satisfy hunger; fruit-eating does not lead to gluttony. By all means must we stimulate the artistic appreciation of fruits.

Sometimes we think there is inharmony and perhaps even antagonism between the points of view of the amateur and the regular commercial grower, although there has been little, if any, misunderstanding of a personal kind; fruit-raisers have been singularly sympathetic. But the objectives may be different. It is perhaps in the question of varieties that the divergent objectives are most apparent. The home grower wants a considerable range of varieties; he is keenly interested in new kinds. We come to this convention to view and to admire the varieties on exhibition. Yet we read that commercial growers would strictly limit the number of varieties to be planted, and perhaps would have a standard small list adopted for each state, province or region. Can we reconcile these objectives? This is a very real problem, leading to relationships and points of view in many other subjects. The problem is central to the work of this society.

The traditional influence of this society has been to stimulate the production and appreciation of varieties of fruits, new and old. I am here minded to repeat two or three paragraphs from a paper I read before this society more than a dozen years ago—at the St. Catharines meeting. I then engaged in a retrospect to my first meeting with the society, at Grand Rapids in 1885, now thirty-seven years ago. I recalled some of

the men whom I met there; "and so do I remember the spirit of that convention. The spirit was to test and appreciate good fruits and to name them properly. Marshall P. Wilder, in the president's address, which was read in his absence, dwelt on the great influence of the society in raising the standard of excellence by which our fruits are judged, in establishing a uniform system of rules under which fruits are to be exhibited, the great advance made by the publishing of its catalogue of approved fruits, and in the spread of correct ideas of nomenclature. He emphasized the importance of producing new fruits by raising seedlings of the most approved kinds; and he especially urged the society to use all its influence to give American pomology a high character as a science. How different all this sounds from the discussion of the present day!"

"Let us stop once more to admire an apple. I see a committee of the old worthies going slowly and discriminately among the plates of fruits, discussing their shapes and colors and sizes, catching their fragrance, debating their origin and their history, and testing them with the utmost precaution and deliberation; and I follow to hear their judgment.

"This variety is very perfect in spherical form, deeply cut at the stem, well ridged at the shallow crater, beautifully splashed and streaked with carmine-red on a yellowish green under-color, finely flecked with dots, slightly russet on the shaded side, apparently a good keeper; its texture is fine-grained and uniform, flavor mildly sub-acid, the quality good to very good; if the tree is hardy and productive, this variety is to be recommended to the amateur for further trial. The next sample is somewhat elongated in form, rather below the average in color, the stem very long and well set and indicating a fruit that does not readily drop in windstorms, the texture exceedingly melting, but the flavor slightly lacking in character and therefore rendering it of doubtful value for further test. Another sample lacks decidedly in quality, as judged by the specimens on the table, and the exhibitor is respectfully recommended to withdraw it from future exhibitions; another kind has a very pronounced aromatic odor, which will commend it to persons desiring to grow a choice collection of interesting fruits; still another is of good size, very firm and solid, of uniform red color, slightly oblate and therefore lending itself to easy packing, quality fair to good, and if the tree bears such uniform samples as those shown on the table it apparently gives promise of some usefulness as a market sort. My older friends can construct the remainder of the picture."

The scientific papers and discussions were good at that meeting, now so long ago; yet I recall the varieties of fruits, because I remember the sensitive, careful men who viewed them. The names of those men are still sweet old memories to me. This attention to the kinds of fruits was not peculiar to the Grand Rapids meeting, for in the old by-laws is the provision for the appointing of the fruit committees and the declaration that it shall be the duty of one of the committees "to examine, and, before the close of the session, report on all new seedling varieties that may be exhibited."

But we must not forget, also, that the purpose of these réports was to "prove all things" and "hold fast that which is good." These com-

mittees were fearless in disapproving of poor and duplicate varieties; and the society has exerted a powerful stabilizing influence on the introduction of new varieties and on the appropriate naming of them. Persons having meritorious kinds have sought the judgment of the society.

I think the society may still exercise a discriminating and limiting influence, and in a way that will cover the situation. Recommended lists of varieties for commercial planting in the different regions may well be made, be the number of varieties ever so small; the work should be undertaken, however, only by careful study of the situations by competent men acting in committees. I am in sympathy with the making of such standard lists if we keep the other needful considerations well in mind; for the society must meet the needs of the time.

These other considerations are such as these: That we do not discourage the discovery and the production of new varieties, whereby we hope to advance the science of pomology and give scope to the plant-breeder and to every other person who is looking beyond; that we do not reduce fruit-growing to mere standardized quantity-production, as we tend to reduce manufactured articles at such a basis, thereby limiting personal choice on the part of the buyer; that we do not confine commercial fruit-growing to the choice of merely good shipping varieties independently of their quality, for in the long run the intrinsic quality of the product will determine our success even as the quality of a man's life, rather than the gain, is the measure of it; that we recognize the need of variety in life, for in a world abounding in lovely and interesting thinks we have no right to prevent any man in appreciation and enjoyment of them.

We must indeed recognize the fact that there is merit in variety; for has not Cowper taught us for more than a century that "variety's the very spice of life?" The tendency of our day to reduce everything to uniformity, whereby we may organize, regulate and govern it, is in reality a process of suppression and the eliminating of personality, even in a time when personality is needed more than ever before. We must not tie things up too tight. And here is where we need the conserving influence of the amateur, who is interested in collecting, whether of fruits or books or objects of art, in order that we may have the privilege of contact with abounding variety, that the affections may expand and the soul may grow. This, also, is one of the needs of the time. I hope I am permitted to copy here a statement on this subject that I have elsewhere put in print ("The Apple-Tree," p. 77) "The objects and productions of high intrinsic merit are preserved by the amateur. It is so in art and letters. It is necessarily so. A body of amateurs is an essential background to the development of science. The late Professor Pickering, renowned astronomer, encouraged the amateur societies of star-observers, and others. The amateurs in the background, disinterested and unselfish, support appropriations by legis'atures for even abstruse public work. The amateur is the embodiment of the best in the common life, the conservator of aspirations, the fulfillment of democratic freedom. I hope pomology will not lag in this respect. In all lines I hope that professionalism will not subjugate the man who follows a subject for the love of

it rather than for the gain of it, or for the pride of it. In horticulture, when we lose the amateur, who, as the word means, is the lover, we lose the ideals.

"Naturally, the nurseryman cannot grow trees of all the good apples that may be wanted. The experiment stations cannot maintain living museums of them, for their function is to investigate rather than to preserve. Arboretums are concerned with other activities. Is there not some person of means, desiring to do good to his successors, now ready to establish a fructicetum *in perpetuum* for the purpose of preserving a single tree of at least one hundred of the choicest apples, to the end that a record may be kept and that amateurs may be supplied with cions thereof?"

Can not this old and careful society meet the important commercial and regulatory needs of the day by recommending lists of varieties specially to be considered for market conditions, and at the same time leave the way open for progress and the expression of personal desires?

THE PAST YEAR'S WORK AND THE FUTURE OF THE AMERICAN POMOLOGICAL SOCIETY

Paul C. Stark, Vice-President, Louisiana, Missouri

The aims of the American Pomological Society and the services rendered American orchardists were so clearly outlined by President Bailey in his address last year at Toledo that further reference would probably be duplication.

It might be well to simply mention a few of these aims and accomplishments, such as monthly information letters to members, fruit crop reports, encouragement of better grading and packing, increased fruit consumption campaigns, condensed reviews of new horticultural publications, registration and encouragement of new fruits, inventions and contributions to pomology, legislation encouraged for extension and safeguarding of the fruit interests, cooperation with fruit growers, marketing associations, affiliation with and service to state, provincial and local horticultural societies, thereby acting as a general clearing house of all horticultural information, registration of new fruits and acting as a supreme court in horticultural matters.

In the midst of our new activities, however, we should not overlook the fundamental horticultural ideas that called the society into being. The American Pomological Society should still be the great dignified, scientific body whose rulings in certain things are final, and, while the addition of commercial ideas are necessary as conditions have changed, this society should remember its traditions, dear to us all, that have made it great and respected in its field, and not depart from them.

The executive committee and the officers felt that it was to the best interests of the society to concentrate most of their efforts on a few of these activities, although considerable progress has been made in almost all of the aims mentioned above.

Our secretary has given very conscientious and efficient service to the society, even at the sacrifice of personal interests. Unless one is closely connected with the work, it is impossible to realize how much time and effort was required in handling the secretary's work.

One of the big fundamental accomplishments of the society during the past year was the demonstration of the need and value of the American Pomological Society to the American orchardists and the realization and firm belief in its present and future development. This faith was necessary before this or any other great movement can succeed. All sections of the country, all classes of horticultural interests have recognized the present and potential value of the American Pomological Society. The commercial fruit growers have shown their confidence by increased memberships. The scientific horticulturists, almost without exception, are working hard for the strengthening of the society. The state horticultural societies are urging all their members to join the American Pomological Society, which they are looking to as the "mother organization" and clearing house for all the state and local associations.

The allied commercial industries, such as the spraying concerns, the equipment companies, fertilizer companies, nurserymen, package companies, and others have shown their recognition of the value of the society by helping to obtain more members and by financial support. These concerns have realized that this national organization will help stabilize the fruit industry and help assure good, profitable crops for the fruit grower—and that will benefit all industries who serve the fruit growers.

The cooperative marketing associations of fruit growers have shown this year their appreciation of the value of our society. Especially the Federated Fruit and Vegetable Growers (whose activities some thought would duplicate those of the American Pomological Society) have expressed themselves very decidedly in favor of mutual effort and coordination of work between their association and our society, saying that they realized that our society was working along educational and production lines, while they were solely concerned with marketing, which would more than keep them busy. Our executive committee was invited to the executive meetings of the Federated Fruit and Vegetable Growers and were given the privilege of the floor. Several of us did attend these meetings and, as a result, we feel that the best of understanding exists—both are working for the good of the fruit growers, but along two separate and distinct lines.

This year has not been a rosy one for fruit growers. The coal strike, railroad strikes, and the general unsettled condition of the public mind resulting therefrom, has cost the fruit growers of the United States millions of dollars. However, it has clearly demonstrated the need of a strong central organization of fruit growers that recognized the old saying, "United we stand—divided we fall." "The clouds of the past year have a silver lining" which is now being demonstrated by the improvement in general business conditions and the increased prices that the farmer is getting for his corn, hogs, and other crops. Realizing that the consumption of fruit and the prosperity of the fruit grower depend on the general public, this is indeed an encouraging sign.

This year has further demonstrated that the careful grower who produces good quality fruit, clean fruit, carefully graded and packed, will make a profit either by selling at a premium above the average run of fruit or by storing until the poorer grades are off the market and prices advance.

This year has another benefit in that it has helped to eliminate the lazy man who thinks that fruit growing is "no work and all profits." The sooner that type of grower goes out, the better it is for the industry, because orcharding requires plenty of "brain work, back work, and faith."

I often think of what was told me by the late Professor Whitten, whose death was a great loss not only to the American Pomological Society, but to the whole fruit industry. Professor Whitten said that he considered San Jose scale one of the greatest blessings ever bestowed on the fruit industry, because it helped the careful, efficient growers who could control it, while the lazy, careless grower was eliminated—"the survival of the fittest." This thought is more or less true of the other orchard pests.

This condition was brought out clearly on a 7,000 mile automobile trip that I took this summer through the orchard sections east of the Mississippi river. Most of the successful, brainy growers were men who were following up-to-date business methods in their orchard work—active, energetic young men or older men with young ideas, which gives the same result. These men love their work—and they are hard workers, both with brain and muscle. That is a combination that can't be defeated—and to me it is the most encouraging feature for the future success of the orchard industry—it is a substantial and sound foundation.

On this automobile trip we visited several hundred of the leading orchards and talked with several thousand fruit growers in their orchards or at the various summer horticultural meetings. The officers of the horticultural societies seemed willing and anxious to have us present to give their growers the facts and advantages of membership in the American Pomological Society, and in these talks and in personal talks with the growers I didn't find a man who was not interested in the work of the society and expressed himself as realizing the need of such a national organization. On my return home I wrote to these growers and many of them have joined the society and many more will join later, I believe.

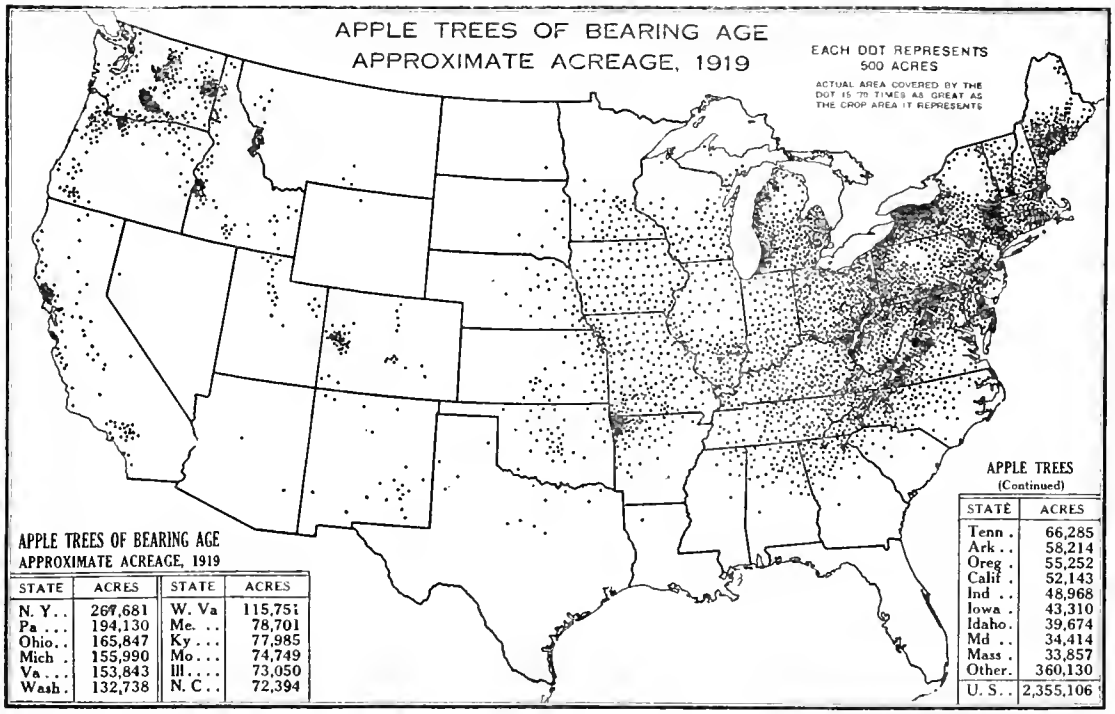
In this connection, I would suggest that some member of the American Pomological Society in each state or section be appointed to present the benefits of membership in the society to every meeting of growers in every state during the coming year. If this is continually done, I believe that a very large active membership can be secured in all the leading orchard sections. The growers have realized that crop conditions outside of their own state affect their profits more than their local conditions and they are ready and anxious to get this general, national crop information from a reliable source.

Babson and the other statistical organizations have shown by many past instances that the man or organization conducting a fundamentally sound business (whether it be fruit growing or manufacturing) and who follows a carefully studied plan of broad and sane development will win out in the long run. It has been the experience that those who have followed this line of development—not being affected by over-development in boom periods or periods of inflation, but, on the contrary, have gone ahead when others let up when times temporarily looked bad, were the ones who won out in the end.

THE GEOGRAPHY OF APPLE GROWING IN AMERICA

H. P. Gould, Pomologist, U. S. Department of Agriculture, Washington, D. C.

Mr. President, Members of the American Pomological Society, Ladies and Gentlemen: The president dignified my part on the program by calling it an address. It is not to be an address. It is to be absolutely informal, and if I don't learn more about the geographical distribution of commercial apple growing in the United States before I get through than does anyone else here, it will be because I am not able to get the response from those in the audience that I hope I shall get.



APPLE TREES OF BEARING AGE
APPROXIMATE ACREAGE, 1919

STATE	ACRES	STATE	ACRES
N. Y..	267,681	W. Va	115,751
Pa ...	194,130	Me. ..	78,701
Ohio..	165,847	Ky ...	77,985
Mich .	155,990	Mo...	74,749
Va ...	153,843	Ill...	73,050
Wash.	132,738	N. C..	72,394

APPLE TREES
(Continued)

STATE	ACRES
Tenn .	66,285
Ark ..	58,214
Oreg .	55,252
Calif .	52,143
Ind ..	48,968
Iowa .	43,310
Idaho.	39,674
Md ..	34,414
Mass .	33,857
Other.	360,130
U. S..	2,355,106

FIG. 1.—About 15 per cent of the acreage of apple trees of bearing age was in the West in 1920, and nearly half of this western acreage was in the state of Washington. New York, Pennsylvania, Ohio, Michigan, and Virginia, however, exceeded Washington in acreage. Most of the apple acreage of the nation is found in the Hay and Pasture Region from Maine to West Virginia and Michigan, where the climate is cool, but owing either to lake or mountain protection, the winters are moister and less severe than in the interior of the continent. (U. S. Department of Agriculture Yearbook, 1921.)

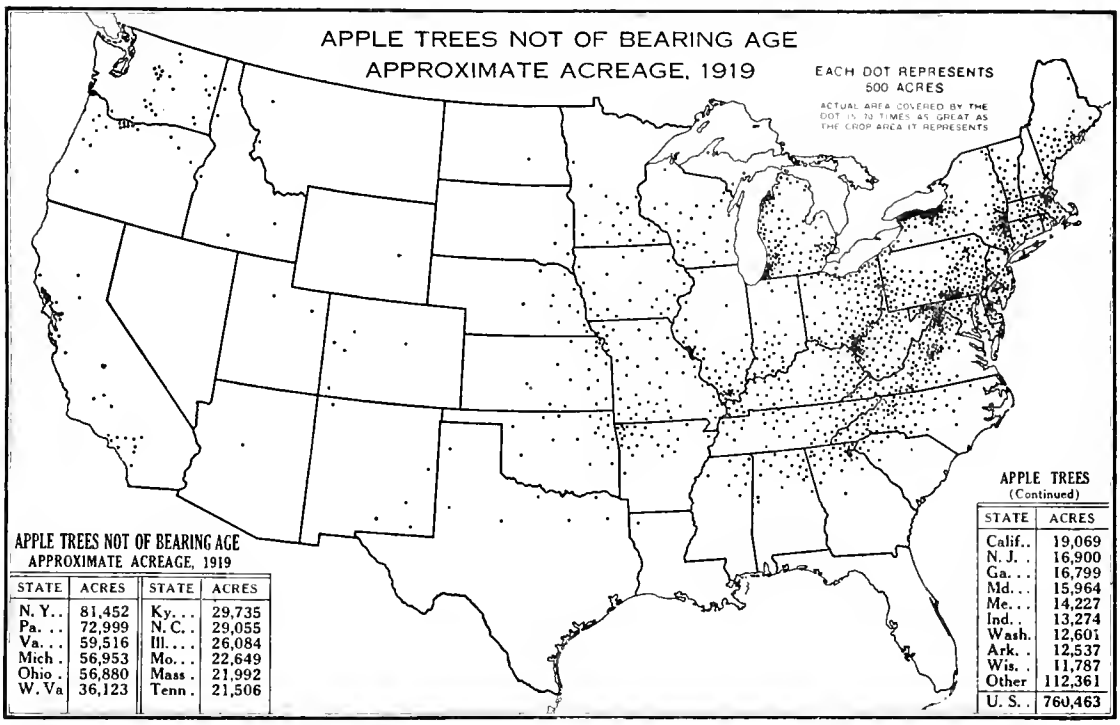
I want to apologize to any of our Canadian representation that may be here, and to their spirits if they are not here in person, (because I know they are here at least in spirit if they are not here in person), for omitting in any definite thing that I may say all reference to the distribution of commercial apple growing on the other side of the border. I am not so narrow-minded as to think that America applies only to the United States. I have simply not had time to get the necessary information which would enable me to say anything except in a most incidental way about the geographical distribution of commercial apple growing in Canada.

I wish there was some way of projecting before you some maps that are publishd in the 1921 year book of the department of agriculture which are based on the census of 1920. These maps show the acreage of

bearing apple trees in the United States and their distribution; also the acreage of trees not of bearing age (see figures 1 and 2).

As it is not possible to project those maps before you, I have here three year book separates in which four maps are given. Possibly you can pass them back and forth and get just a glance, just a bit of visualization of the way the acreage of bearing trees and the acreage of non-bearing trees and the production looks when it is projected on a map on a dot basis.

Now, if you are able to see the outline map that I have displayed here, you will visualize in just a moment the substance of all I want to say,



STATE	ACRES	STATE	ACRES
N. Y..	81,452	Ky.. .	29,735
Pa. ..	72,999	N. C..	29,055
Va.. .	59,516	Ill.. . .	26,084
Mich .	56,953	Mo.. .	22,649
Ohio .	56,880	Mass .	21,992
W. Va	36,123	Tenn .	21,506

STATE	ACRES
Calif..	19,069
N. J. .	16,900
Ga.. .	16,799
Md.. .	15,964
Me.. .	14,227
Ind..	13,274
Wash.	12,601
Ark. .	12,537
Wis. .	11,787
Other	112,361
U. S..	760,463

FIG. 2.—There has been very little planting of apple orchards in the West in recent years, the higher freight rates increasing the difficulties of competition with eastern grown fruit. Less than 9 per cent of the apple trees not of bearing age were in the West in 1920. Most of the acreage of young trees, it will be noted on the map, is located along the shore of Lake Ontario in New York, in the lower Hudson Valley, in New England, along the Appalachians from Pennsylvania to Georgia, in the upper Ohio Valley, along the Lake Michigan shore of Michigan, and in the Sonoma Valley of California. Trees not of bearing age numbered 36 million in 1920 as compared with nearly 66 million in 1910. (U. S. Department of Agriculture Yearbook, 1921.)

because I have attempted to indicate on this map the principal areas in the different states where apples are grown commercially.

I realize perhaps more keenly than the most of you here do how imperfect it is. In some of the states the commercial areas are fairly definitely delimited. In other states the commercial districts are pretty diffused. It is pretty difficult to put your finger on any particular section and say "this is the region in which commercial apple production occurs." But as I go along, and get to certain states in my talk, as I said a moment ago, I am going to ask different people whom I see here in the audience to make their own claims with regard to their own states.

Starting with the New England states, in Maine there is scattered

commercial production pretty well over the southern half of the state, with the largest concentration in Kennebec county. The same is true with regard to New Hampshire, the largest production being rather scattered through much of the southern half of the state. In Vermont the production is in the southeastern and southwestern parts of the state, with the outstanding concentrated commercial apple district being in the northwestern part of the state bordering Lake Champlain. It is one of those many interesting instances where a body of water has been the determining factor in the location of an important commercial fruit district.

In the other New England states—Massachusetts, Connecticut and Rhode Island, the apple industry is widely diffused. While there are some centers of relatively large production, the industry is mainly one feature of a general agriculture—a type of fruit growing which has some large advantages as well as disadvantages when compared with specialized fruit growing.

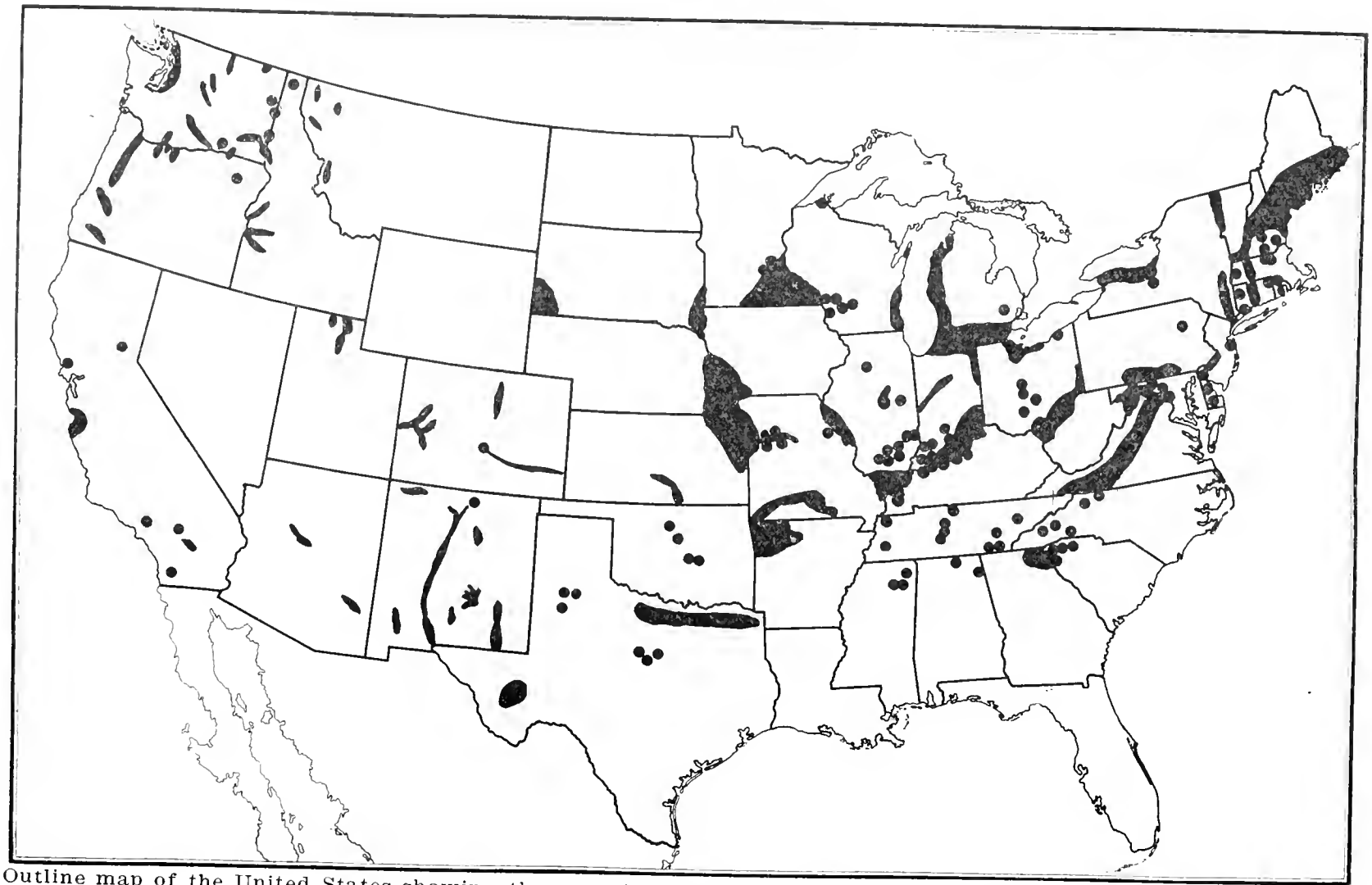
In New York, if you notice on those small maps in the year book separates that are being passed around, the dots are distributed pretty uniformly over a large portion of the state, with the exception of an area in the north central part of the state where there are very few apples. The important commercial districts, however, occur in the Hudson river valley and in the four or five counties bordering Lake Ontario and to some extent in the second tier of counties extending, also, in the region of the Finger Lake district in the west central part of the state.

Coming to Pennsylvania, that is another one of those states where apple production is pretty well distributed over the entire state. If you will note the small map showing the distribution of the trees you will observe that the dots are pretty uniformly distributed over the state. But there is an outstanding concentration of the apple industry in the four or five counties in the south central part of the state, counties which are distinctly in the Blue Ridge or the Appalachian mountain district—York, Adams, Bedford and Franklin counties being the ones of special importance. And then in Luzerne county there is also a large production. That is the county in which Wilkes-Barre is located.

I think I can illustrate the distribution of apple growing in Pennsylvania by referring to the figures for cherries for Pennsylvania given in the thirteenth census. According to those figures, Pennsylvania was one of the largest cherry producing states in the country. When five or six years ago I was devoting considerable attention to cherry growing, I undertook to locate the commercial cherry growing districts in Pennsylvania, and I simply found "that they weren't"—they didn't exist. But cherries—yes, they are there, but they are scattered in small orchards pretty much all over the state, and if the fruit is sold at all it simply goes into local markets. And, of course, being the large industrial state which it is, Pennsylvania furnishes a large local marketing opportunity.

The distribution of apples in Pennsylvania is very much the same as cherries, except the rather large commercial development in the southern counties as described.

In New Jersey, there again the same thing holds true to a considerable extent, with the principal commercial development in the west central



Outline map of the United States showing the more important commercial apple producing sections, together with some of the sections of secondary importance.

part, in what might be termed the Philadelphia region—in Monmouth, Burlington, and Gloucester counties, and in one or two other sections in the west central portion of the state; that area being the large commercial producing district.

It is going to take too long if I attempt to go over each state in this way. So I think I will hurry along and not attempt to indicate the region in the different states so much by counties as by general regional locations.

Delaware, though small in area, grows many apples. The industry is largely located in Kent county, but extensive developments have occurred in Sussex, with smaller interests in New Castle county.

In Maryland apple production is mostly in the western part of the state in the mountainous section, Frederick and Washington counties being typical.

Then, in Virginia, the principal apple district is represented by a belt, roughly speaking, two counties in width, extending in a northeast and southwest direction, the counties being those which have their common boundary line on the top of the Blue Ridge mountains. The row of counties on the western slope of the Blue Ridge and which extend into and for the most part across the Shenandoah valley and the counties which cover the eastern slope of the Blue Ridge extending into the Piedmont region comprise this district.

In West Virginia the apple industry is extensive but not located in especially well defined areas. Production is important in the counties comprising the eastern panhandle, representing the lower Shenandoah valley and the Potomac valley; then at various points along the western border of the state in the Ohio valley. Formerly many apples were grown in the northern panhandle, but the industry has declined there.

In North Carolina there are large potential apple possibilities in the mountainous section in the western part of the state, and considerable production is already in progress in several counties.

The corresponding part of South Carolina has likewise some possibilities which are only partially developed.

A considerable development in commercial apple-growing has been developed in northeastern Georgia, particularly in Rabun and Habersham counties, the two northeasternmost counties in the state, with some development in the other northern counties; those counties representing the southern extension of the Blue Ridge and Appalachian mountains.

Tennessee: Some production in the lower portion of the Cumberland valley, some in the central part of the state and a limited production in the western part of the state.

In Alabama, a few orchards in the northeastern part of the state; and a few in northeastern Mississippi. But, of course, from the commercial standpoint, those orchards are negligible.

In Kentucky limited production is pretty generally distributed over the state, but the commercial orchards are largely along the Ohio river.

In Ohio—will someone from Ohio please speak? I know certain distributions, commercial orcharding being quite largely along the Ohio river, in the southern part of the state, some in the central part and

pretty generally throughout the lake shore counties, with a rather wide distribution throughout the entire state; but these particular districts that I have mentioned are the most outstanding from the standpoint of large commercial production.

In Michigan the apple industry is widely distributed. Oakland county, in the southeastern part of the state, stands out prominently; large quantities are grown in the southern tier of counties; but the district which stands out in comparison with all others, not only for apples, but for many other fruits, is in the western tier of counties, and consists of a comparatively narrow belt bordering on Lake Michigan.

Indiana: I saw Professor Greene, didn't I, come in a little while ago? I expect now to hear from him. In Indiana, as far as I know, the most important commercial apple producing counties are along the Wabash river in the west central part of the state, a little north of the center perhaps, and pretty generally through the southern third of the state. Is that sufficient? Can the production be localized, Professor Greene?

Mr. Greene: Not very specifically.

Mr. Gould: This is another one of those cases of rather generalized distribution.

To a large extent the same is true, so far as I know, in Illinois, with the large producing areas pretty generally distributed over the southern third of the state, with large production in the counties bordering the Mississippi river; several counties north of St. Louis, that is, north of that latitude, with a large production; but the orchards more isolated in individual counties in the north central part of the state, including Champaign, Bureau and several others. Professor Blair, how about it?

Prof. J. C. Blair: That covers it very well. The areas are between the Illinois and the Mississippi; then in the south, the Ozark region.

Mr. Gould: It is rather difficult to localize those areas to the extent that can be done in many of the states.

Arkansas: The large production is in the northwestern corner of the state. A half dozen counties produce by far the larger part of the apple crop; in fact, nearly all of the commercial production.

In Missouri the southwestern-most counties and the counties through which the St. Louis & San Francisco Railroad passes; that includes Greene, Webster, Texas, Oregon and several others. There are also quite a number of counties along the Missouri river in which many apples are grown. And again, there is to me a most interesting district, one which includes the northwestern counties of Missouri, the northeastern counties in Kansas, the southeastern counties in Nebraska and the southwestern counties in Iowa. The area thus composed represents some of the most important apple growing interests of the four states concerned, although the Arkansas valley in Kansas should be mentioned, especially centers of production that occur in Reno, Sedgwick, Sumner and Cowley counties, and in Iowa the southern half of the state produces a great many apples, with commercial orchards pretty generally distributed over them.

Perhaps some of the Iowa people here would like to amplify what I have said with regard to their state. If so, it is your privilege.

Mr. Reeves: You have that right.

Mr. Gould: In Wisconsin, Door county, consisting as it does of a peninsula, is the banner county of the state in one respect. I think it is the only one in Wisconsin in which there were reported a larger number of bearing trees in 1920 than in 1910. There is some production along Lake Michigan, likewise in three or four counties in the southwestern part of the state north of the Wisconsin river—Crawford, Sauk, Richland, and possibly others.

In Minnesota, the southeastern corner with the Lake Minnetonka district is the center of quite a large production, relatively speaking. Elsewhere in the state production is rather light and much scattered.

South Dakota: Quite a large production, relatively speaking, in the Black Hills section and some in the southeastern counties. But for the most part we will pass over North Dakota and South Dakota.

Oklahoma: Scattered production, but not any very great amount by way of totals. But in Logan, Garfield and Canadian counties, all in the central part of the state, there are commercial orchards of some importance.

Texas: Not very much can be said about apple growing in Texas, yet there are some counties in which they are found in some quantity. These are located in general in the northeastern part of the state; in Floyd, Hale, Lubbock and other counties in the panhandle region, and in the southwestern section some production is also reported.

New Mexico: The apple districts in New Mexico have been outlined in detail by Professor Garcia in a bulletin published some years ago by the New Mexico Experiment Station. The Pecos valley, in the southeastern part of the state, is the largest producing area in the state. But apples are grown at numerous points along the Rio Grande valley as well as in smaller irrigated valleys or districts in several other parts of the state.

In Colorado the principal area, of course, is the Grand valley in Delta in the western part of the state; then in the Gunnison valley in the same county, with the industry centering about Delta, Hotchkiss and Paonia, and Montrose in Montrose county. These centers, together with a number of others of less importance, make up the "western slope" fruit interests of the state. East of the mountains the Canon City district in Fremont county is important, as are various other centers along the Arkansas river valley in its eastern course through the state.

In Utah commercial apple growing is confined mostly to the northern part of the state, interests occurring in the eastern part of Box Elder county, and in Cache, Weber, Davis, Salt Lake and Utah counties. The industry is located largely in irrigated valleys and to some extent where the influence of Great Salt lake and Utah lake doubtless moderates the climatic conditions somewhat.

There is little to say about Wyoming, Nevada or Arizona, as they are among the few states that are scarcely represented in the commercial apple world. And yet in restricted areas and in limited quantities very excellent apples are produced in each of these states.

In Montana, in the western part of the state, the Bitterroot valley and the Flathead lake country have figured rather largely in the apple world during the past ten years, but because of the extensive plantings that

were made, and many of which have failed, rather than because of any important production that has come out of these districts.

In Idaho, the valleys in the western part of the state, centering about Nampa, Payette and Weiser, and the Boise valley have witnessed extensive orchard developments. Then, farther north in the state, with the areas extending over into Washington, there are the Palouse section, the Lewis and Clarkson area and one or two others of lesser importance.

In Washington the production that we really hear about is largely in two great valleys, the Yakima and the Wenatchee valleys. But there are many apples grown in the Walla Walla valley, in the Palouse region in the east central section, and in the Okanogan district in the north central part of the state, with some production in the Puget sound region; these areas being the outstanding ones, but with a number of other smaller ones.

Oregon: The northeastern part of the state in the Milton Freewater section, which is substantially an extension of the Walla Walla valley; in Union county, in the northeastern part of the state; then in the northern part of Wasco county, two or three districts; the Hood River valley, the Willamette valley, the Umpqua valley, and the Rogue river valley—all of these districts contribute to the apple production of the state.

And finally, California: Until rather recently about sixty-five per cent of the commercial apple crop grown in California was produced in the Pajaro valley, or, as more commonly called, the Watsonville district; in Sonoma county, the Sebastapol section has been producing fifteen or sixteen per cent of the crop of the state. But during the past eight or ten years other sections have been developing and are now calling for recognition. One of these newer districts is in the southwestern part of San Bernardino county in the general vicinity of Redlands, known as the Yucaipa district. That area is a magnificent sight. I don't know how many thousands of acres there are in it, but there are several, four or five thousand, I think at least. It is practically a solid orchard. You can go back on the hills, just a little way, and get a view over the whole area. Most of the orchards are now in the neighborhood of ten years old and are just coming into quite large production.

Then another district is in the northwestern part of Riverside county, not many miles from the Yucaipa district, there are Banning and Beaumont, comprising a center of rather large apple interests.

Then there are some plantings in Los Angeles county and in San Diego county at some of the higher elevations, making, so far as distances are concerned, the production of apples and the production of oranges and other sub-tropical fruits in rather close proximity to one another. But this comes about through the differences in elevation and the resulting differences in temperature.

Now, if you will bear with me just a few moments longer, I want to continue what I started to say and what a lot of others started to say a year ago in trying to interpret and apply the census figures.

I think in the course of what I said I suggested the possibility that the reduction of thirty-six million bearing trees as indicated by the census of 1920 as compared with the census of 1910 (the figures being in round numbers 151,000,000 in 1910 and 115,000,000 in 1920), might not mean

just what it appeared to mean through simply a superficial consideration of the figures.

It was suggested that possibly the reduction might not represent a correspondingly large decrease in the potential apple production of the country.

My point was that possibly a very considerable proportion of the decrease had taken place, not in these important commercial apple producing districts, but in the areas where the orchards were principally farm and home orchards; in other words, orchards the product of which never entered to any considerable extent into commerce.

I have listed the more important apple growing counties with their respective number of bearing trees in thirty-seven states and if I have reckoned up the figures accurately I think there are twenty of the thirty-seven states, which, on the basis of these apple producing countries, show an actual decrease, while there are seventeen which show an increase.

I have grouped the states according to the census grouping. There is the New England states, the middle Atlantic, the east, north, central, etc.

The number of bearing trees in 1910 in these important counties that I have listed was 46,000,000. In 1920 in those same counties the number was 44,000,000 in round numbers. Now, in the states in which there was a net increase, the increase was 9,600,000 trees. In the same way, the states in which the larger apple growing counties show a decrease, the total reduction in those counties was 11,680,000, so that in round numbers on the basis of that comparison there was a decrease of two million bearing trees during the decade 1910 to 1920 in the more important commercial producing counties. That looks somewhat different from a decrease of 36,000,000. The conclusion is that the decrease of the other 34,000,000 occurred in counties relatively unimportant from a commercial standpoint.

An analysis of these figures is not without its interest. Of the increase shown, nearly 7,000,000 trees were in the Pacific states and in the inter-mountain states. Of the decrease, a very considerable proportion occurred in Arkansas, Missouri, Illinois and Kansas.

Now, taking the states in which there was an increase, it is of interest to note that they comprise the Pacific coast states and the inter-mountain states in the west and the states in the east through which the great Appalachian mountain system extends, reaching from New York in the north to Georgia in the south. The decrease in bearing trees, so far as the large commercial districts are concerned, occurred in the New England states (as a group) and in the great interior valley regions of the Mississippi, the Ohio and the Missouri rivers, together with their adjacent tributary areas.

Mr. James Sharp: May I just give you a little illustration? Spokane county in 1920 had more apple trees growing than Yakima county. In 1919 Spokane county shipped about four hundred carloads of apples, while Yakima county shipped thirteen thousand.

Mr. Gould: There are a lot of those comparisons that could be made all the way through.

Mr. B. G. Pratt: That is very interesting, but I'd like to know what

has become of the sixty-five million apple trees under bearing age in 1920. They seem to have been lost in the shuffle. In 1910 there were 110,000,000 trees of under-bearing age, which in ten years were either alive and bearing or dead. So when you reduced the number of trees to 115,000,000 bearing trees, they must be lost somewhere.

Mr. Gould: Well, I am not attempting to explain where they went; but unquestionably a great many of them are dead.

Mr. Cranefield: I think your investigations confirm only what Vice-President Stark said and what Professor Bailey conveys to us in his message that the careless man is getting out of this game. God is impeding his progress. Your description, it seems to me, hooks up with Mr. Stark's and Mr. Bailey's thought.

Mr. Gould: I was rather interested to see that out of that thirty-six million reduction between 1910 and 1920 so small a portion apparently took place in the important commercial apple producing states of the country. Taking those as a whole, as I pointed out, the increase is in the inter-mountain and the Pacific coast states, and in the Atlantic coast and the mountain states in the east, with the really striking reduction occurring in the great Mississippi valley region and the important tributaries, including the Missouri river and a very considerable portion of the Ohio river valleys.

THE CHERRY INDUSTRY IN WISCONSIN

M. B. Goff, Sturgeon Bay, Wisconsin

Type Varies from New York and Michigan. Those fruit growers who are familiar with the cherry orchards of western New York and much of western Michigan would be somewhat surprised to visit the concentrated areas of the Wisconsin cherry belt in the Door county peninsula. In New York state comparatively few orchards of sour cherries exceed ten acres in extent, and many of the fruit growers consider their sour cherries as a side line, as is evidenced by the fact that a considerable percentage of the cherries in New York state are raised along the roadside or in small blocks, interspersed between apples and pears. In western Michigan few fruit growers have cherries exclusively, and most of them prefer to use the New York plan of diversifying their acreage. In Wisconsin, however, large numbers of fruit growers raise practically nothing but cherries, and many corporations make the growing of this fruit their sole business.

The Industry Located Largely in Door County. Sour cherries are grown in Wisconsin almost wholly in the Door county peninsula, which, as one looks at the map, is the thumb of land jutting out into Lake Michigan from the northeast corner of the state. In the Bayfield peninsula, which bears a similar relation to Door county, in the Lake Superior region, sour cherries are grown to a small extent, but no orchards of large size exist in that locality, and few, if any, of the growers make cherries their principal business. In southwestern Wisconsin some cherries are grown in the unglaciated area of the Kickapoo valley. In western Wisconsin there are some limited plantings of cherries on the rich soils of the Eaugalla river region. One company in this area, although largely devoting its energy to the growing of apples, has made a start in sour cherry planting. The regions enumerated are by no means all of the localities in Wisconsin which could profitably grow sour cherries. The peculiar topography which has in a measure assisted the success of the Door county region is caused by a belt of Niagara limestone which extends, in the form of an escarpment, from the tip of the Door county peninsula in a belt down the whole eastern side of the state. The cliffs of this formation appear on the eastern shore of Lake Winnebago, and forms a more or less regular range of bluffs and hills down through Calumet, Fond du Lac, Washington, Waukesha, Racine, and Kenosha counties. This whole area includes a similar type of Miami clay loam to sandy loam soils which are underlaid largely by a strong red clay subsoil. Almost anywhere on the well-drained soils of this area fruit trees thrive. The elevations are sufficient to give ample frost protection, and the whole relationship of this locality to transportation and markets is such that it will some day become one of the foremost fruit growing regions of the middle west. Apparently, the chief limiting factor in the spread of the commercial sour cherry industry is the strong tendency of the fruit buds to winter killing. The Wisconsin climate is much more rigorous in its extremes than that of western Michigan and the Ontario shore of New York. Consequently, any locality which proves profitable

for sour cherry growing in Wisconsin must be so situated as to give sufficient annual terminal growth to allow the maintenance of the spur system of fruiting. Repeated experiment under Professor Roberts' direction at the Wisconsin station have demonstrated beyond doubt that fruit spurs are much less likely to receive serious winter injury than fruit buds which grow on laterals. The spur system is, of course, only maintained by vigorous terminal development. Even localities which are able to secure a terminal growth of twelve inches or more may have a growing season sufficiently long to induce over-development of the fruit buds, which in itself makes them more susceptible to winter injury. The Door county area has the happy combination of these desirable soil types, only a moderately long growing season, and a situation in Lake Michigan which greatly reduces frost danger, so that this area has logically developed into what is perhaps the most concentrated sour cherry growing area in the world. In my discussions I shall confine myself principally to Door county, because of the preponderance of its industry in Wisconsin.

History

The development of the Door county cherry region has furnished a striking example of the general attitude of the public toward any untried enterprise. The plantings began with experimental acreage immediately following the World's Fair in Chicago, the first of which was made by Mr. A. L. Hatch, a veteran horticulturist of Wisconsin's early days, in company with his son-in-law, D. E. Bingham, and my father, E. S. Goff, at that time horticulturist of the Wisconsin station. The enthusiasm of these men was reflected in a small number of other plantings made by neighbors, but the general attitude in the locality was one of skepticism, and it remained for these orchards to reach maturity, and prove beyond all question of doubt that the industry held promises of success before there was any large scale of expansion. The next considerable planting began in 1909. In 1910 the first orchard of over forty acres of sour cherries was planted. In 1911 a very rapid expansion began, which saw approximately 3,500 acres planted by the close of 1913. Although the war conditions served to retard further acreage, it is a grave question whether even without the war further planting would have been done until this large expansion had demonstrated itself as advisable. Consequently, another period of ten years passed, during which the orchards that had been started were brought to maturity, and again demonstrated their success. The spring of this year saw approximately 700 acres of sour cherries planted. The spring of 1923 promises at least 1,000 acres, with every indication that the year following will see another large expansion. Whether the growth will outstrip the former plantings to any extent that will much more than replace the losses of trees in the former plantings still remains to be seen; but, at any rate, the sour cherry industry of Door county is on a permanently large commercial basis. From a financial standpoint, each of these cycles of orchard development have been exceedingly interesting. Most of the growers and corporations which engaged in the business entered it without sufficient capital; most of them developed their holdings by borrowing to

their limit; most of them survived and rapidly reduced their indebtedness when their orchards reached maturity. In all cases, the value of the orchards at maturity, based upon an income-returning basis, have proved sufficient to absorb all of the development costs and leave the orchards capitalized on a conservative, sound basis. This is a notable difference from some commercial regions which have developed in this country. The Door county area has not been inflicted with the promotional stock selling type of organization, and those investors who have lost money in the Door county business have been almost solely those who have failed to do their own proper part in the care of their acreage.

Cultural Problems

The varieties planted in Door county have been almost solely the Early Richmond and large Montmorencies. These varieties have been planted in approximately equal numbers. Mahaleb stock has been largely used, although sprouts from the stock in many orchards show a sprinkling of Mazzard. One year trees have been most extensively planted, and the stock has come largely from southern Indiana. English Morellos have not been planted to any extent. The Richmonds and Montmorencies have made a harvesting season sufficiently long to make the addition of Morellos a rather serious problem from the picking and marketing standpoint. Door county is the last section to come in with its cherries each year, and on that account its season invariably approaches the season for peaches and other early fall fruits. The Morello has also not proved as vigorous and productive a tree as the other varieties. Uniform distance for planting is twenty feet apart in squares. Some orchards are planted on the diagonal or hexagonal plans. One large orchard has been planted as fillers in a permanent apple planting. Some orchards have been planted at greater distance than twenty feet, but, on the whole, this standard distance has proved more acceptable.

Clean cultivation has been religiously followed, and is carried out from early spring until picking time, which is after the first of July. The opinion of some growers is in favor of extending the cultivation period well into August, because of a belief that this additional cultivation will somewhat increase terminal growth, and will occasion a retarded development of fruit buds, which makes them less subject to winter killing. The general practice, however, is to cease cultivating at the beginning of the fruit harvesting. Tractors are used to a great extent in orchard cultivation. The caterpillar type is gaining in preference. Tandem discs are used. In the spring little plowing is done. Through the summer, spring-tooth harrows are used of as large size as the power of the tractors permit. In order to get well under the trees, many orchards are using what is known as a split drag, consisting of two spring-tooth harrows, one at each end of a long evener. Fertilization is employed in one form or another by all growers, but has not yet become standardized, although nitrates are recognized as a basis by everyone. A number of orchards use stable manure; some of them have herds of beef or dairy cattle for this purpose. Others purchase large quantities from terminal stockyards. One orchard alone, the cooperative orchard company, which

has 600 acres of cherries, uses close to 100 cars of stockyard manure annually. Cover crops are grown only in very irregular fashion. Cover crops are easily grown in younger plantings, but in the older orchards the dense shading and wide expanse of the root systems of the trees seriously interferes with a good stand. A sufficiently dense weed growth can always be secured to insure a deep covering of snow. Commercial fertilizers are used in increasing volume with nitrate of soda, and sulphate of ammonia greatly in the lead. The use of potash and phosphate is not at all uniform. Many growers use nothing but nitrates. A standard application for bearing cherries has become from three to five pounds of nitrate of soda or its equivalent.

Spraying has become very much standardized owing to the valuable work of the Wisconsin station. Three applications of bordeaux mixture of a strength of 3-3-50 are used; one immediately following blossoming, one two weeks later, and another following the harvest. In years especially favorable to the development of disease another application just previous to harvest is recommended. Lime sulphur has proved, in all years, fully equal to bordeaux for the first two sprays, although its timing must be a little more accurate, and the application more thorough. Lime sulphur has not proved so successful for the post-harvest spray, since its effects are not retained so long as those of bordeaux. The Wisconsin station has conducted dusting experiments with fair success, but, like lime sulphur, the dusting has proved ineffectual in the long period following the harvest. As an auxiliary to liquid sprays, particularly in rainy periods, dust promises to become of decided assistance.

The machinery for spraying is undergoing a rapid increase in size and efficiency. Practically all of the larger orchards are coming to tractor drawn equipment, carrying at least 400 gallons of liquid, and capable of maintaining three guns at high pressure. These larger machines prove much more economical because of the possibility of moving continuously without the necessity of stopping at each tree. The tendency is toward still larger machines, but where this movement will cease is still open to debate. Horse-drawn outfits are used by practically all but the largest orchards. However, the big cooperative orchard company uses horse-drawn, air-pressure machines for a great part of its work owing to the difficulty of operating a large number of engine-driven machines without delays due to mechanical troubles. The first disease to be combatted is shot-hole fungus, which in favorable seasons results in the total defoliation of unsprayed trees. Where proper spraying is done, little difficulty has been encountered in the control of shot-hole, although occasionally an extra spray has been found useful. The only insect pests of serious nature are aphis and the pear tree slug. Nicotine sulphate is used increasingly for aphis, although dust promises to be a most effectual remedy. Arsenate of lead used with the other sprays takes care of the remaining insects nicely. Spraying has been sufficiently well done through the whole history of the region to hold insect pests well in hand, with the result that wormy cherries are practically unknown.

Organization of the Industry

It would be strange, indeed, if so concentrated an area had not developed an efficient organization. While much remains to be accomplished in the perfection of the marketing and auxiliary organizations, nevertheless the handling of the Door county cherry crop, from the growing of the trees to the processing and marketing of the product has become the highly specialized work of the Door County Fruit Growers Union and its allied organizations. The union purchases practically all of the growers' supplies, including nursery stock, fertilizers, spray materials and orchard equipment, and finances the growers in buying these items. Through a subsidiary box factory the union secures its packages. Through the Fruit Growers Canning Company the union processes and markets all of the crop which it does not desire to ship as fresh fruit. Through an allied cold storage interest, storage is provided in necessary amounts. Even the picking of the crop is to an extent handled through an organization which recruits pickers, cares for them, and handles them in the picking of the crop of a large number of orchards. At the present time, a realignment and an improvement in the organization is being worked out, which, when completed, will probably consolidate most of the activities in the Fruit Growers Canning Company. The fruit will be secured to the Door County Fruit Growers Union, a strictly cooperative association, by a binding contract for five years. The union will contract with the canning factory for the processing and handling of its fruits, and the canning company will perform the other functions, such as handling supplies, financing growers, picking fruit and marketing. In order to accommodate the increased volume, the canning company is preparing to enlarge its facilities to include a large cold storage plant, a dehydrating plant, a vinegar plant, an increased canning factory, and one or more boats for handling the coastwide collection of fruit from the isloated areas of the county. The success of this industry is best shown by the statement that practically 100% of the 300 odd growers of the county are members. No carload shipments of cherries are made by anyone but the organization. With such complete control of the industry, cooperative marketing has many of the usual problems solved. The handling of the fruit becomes merely a matter of adjusting the volume of business to adequate distribution. The canned goods now go to a large number of the states east of the Rocky mountains, and to some extent even to the Pacific coast. The canning factory has grown to be much the largest of its kind in the country, and last year during the flush of the picking season handled as much as thirty carloads of fresh cherries per day. A larger amount, in fact, than many plants in the country handle in a season. The past season a small amount of cherries was barreled and frozen. This outlet promises to assume increasing proportions. The fresh fruit shipments, while not large in total number of cars, when added to the fruit delivered to the canning factory make approximately 900 cars for a season just past. The cherries canned by the factory, if placed in No. 2 cans and lined up end to end, would form a line reaching from Chicago to the Gulf of Mexico. When it is considered that nearly all of this business is handled within a period of twenty days, any person can

realize the extent to which the efficiency has been developed by the organization. During the past several years the amount of wastage of fruit has been almost negligible and it can safely be said that no fruit has been spoiled due to lack of pickers or inability of the organization to accept deliveries from growers on time.

The harvesting of the crop becomes, as may well be imagined, the chief occupation of every available man, woman and child in this locality. The past year approximately ten thousand people were at one time or another engaged in the harvesting and handling of the crop. Approximately four thousand pickers came in from other towns in Wisconsin and adjoining states. Many of them were handled under the supervision of the Y. M. C. A. and Y. W. C. A. in camps operated by the Cherry Harvesting Association, a corporation formed for the purpose of picking the crop for its members. Other large orchards had camps of their own, the Cooperative Orchard camp containing almost 1,000 pickers. Every effort has been made by the growers to place the handling of the pickers on a satisfactory social and educational basis. As a result, a very high class of help has been induced to return to the orchards annually for this peculiar kind of an outing in the country, which pays for itself. In this manner, the great bugaboo held up by the skeptics who predicted that the large expansion of acreage which occurred just previous to the war could never be handled, have been effectually silenced. It has no longer become a question of whether this enormous volume of business can be handled quickly and efficiently, but is merely a problem of finding the most efficient and economical means of securing results.

Future of the Industry

The successful solving of the growing, harvesting, and marketing problems makes the future expansion and development of the industry a certainty. From the marketing standpoint, a much greater volume of business is justified. The people of the United States have not yet learned to appreciate the sour cherry. Large areas of this country are not accustomed to making cherry pies, and hotels and restaurants in many large cities do not include it on their bills of fare. The large variety of delicacies which can be made from fresh and canned cherries are not known by the public. Careful study of the marketing situation in various centers of the country have convinced the Door county people that they need have no fear of expanding their industry to the uttermost possibilities of the land they have available for development. The problem of marketing is more easily solved when there is sufficient volume of goods to market to justify proper handling facilities and proper marketing and distributing machinery. A small volume of business, and even the present volume of Door county sales is not sufficient to require the fullest stimulation of cherry consumption.

Social Effects of Organized Horticultural Industry

From the fruit growers' standpoint the real success of an industry of this character should be judged, not alone by the profits it produces, but by the type of rural development which follows. The Door county

area promises to vindicate, from the standpoint of rural social conditions, all of the energy which has been expended. With increasing business succcess, there has followed a greater desire on the part of the fruit growers for a higher standard of rural life. This standard is attracting to the business many people who would not be satisfied with the limitations of ordinary rural existence. Such a group of growers makes wider and fuller cooperation a certainty. Tendencies toward increased social intercourse and community helpfulness are becoming daily more apparent. The cooperative organization stimulates proper horticultural methods in every way in its power, encourages scientific studies by close cooperation with the state agricultural college, fosters growers' meetings and demonstrations, and has laid a solid foundation for state development. Judged by these conditions, which are the only fundamental facts that need to be ascertained by the person investigating an industry of this kind, the sour cherry industry of Wisconsin is an outstanding success.

Mr. O. F. Whitney: I would like to ask two questions. What kind of a package do they use and what is the average life of a tree up there?

Mr. Goff: We use the sixteen quart hallock crate for shipping. We have begun to use a ventilated sixteen quart crate, which we feel is superior. And in the future I think our production will be marketed very largely in that kind of crate.

The average life of our sour cherry trees is still debatable. We find the older orchards have become unprofitable at from twenty to twenty-five years of age. The oldest orchards are still in existence, and are still producing a crop every year. And those growers have filled in the vacant spaces and in that way have maintained their production from the land.

Mr. Sharp: What kind of stock do your cherries grow on?

Mr. Goff: Grown most extensively on the Mahaleb; although we find in many orchards where the cultivators have scratched the roots that Mazzard sprouts come up. As a matter of fact, we have many more Mazzards than we thought. Of course, we think that was very satisfactory, because the Mazzard is a very good stock.

Mr. Ritchie: Can you tell us what sprayer is used most and seems to be most satisfactory?

Mr. Goff: I would answer that question by merely telling you what we are using. The Friend and the Hardie are perhaps most used in the large sizes. In the small machines the Bean and the Myers figure about equally with the Friend and the Hardie.

Mr. Davis: What do they net?

Mr. Goff: Our cherries for the past several years have net the grower from ten to ten and a half cents per pound. This year we

expect to pay out on the final check a balance that will produce about eight cents a pound.

Mr. Bingham: What does your picking cost?

Mr. Goff: Our picking costs 2½c to 2¾c a quart, as a rule. Some of the orchards pay more where they have to pay for the supervision of the picking in addition, that is, bringing in people to manage the pickers, chaperons and camp managers, etc. The pickers get two and a half cents a quart. In some cases they pay them an extra bonus for good picking, which brings it up to about two and three-quarter cents for the good pickers. For this next year it looks as though the price will be about two cents a quart.

Mr. Close: How many ounces in a quart?

Mr. Goff: Our crates weigh net approximately twenty-five pounds of cherries.

Mr. Davis: Why do they pay for picking by the quart? It seems to me they should pay for picking by the pound. Why isn't that done?

Mr. Goff: Picking by the quart has developed from the early days when we shipped fruit out altogether and did not operate a canning factory. We still ship considerable fruit, so that for our convenience it is reduced to quarts there instead of pounds. Either way, of course, would work.

Mr. Davis: Well, I know that in my part of the country they pick a ten pound pail full and they think they have a gallon; but they haven't.

Mr. Goff: Well, we check our weights and keep our measures full.

Mr. Simpson: Do you pull them with the stems on?

Mr. Goff: We pull them with the stems entirely for the shippers.

Mr. Davis: Which is the best way for the trees?

Mr. Goff: It is a great argument. We can say this: that trees which have had the cherries pulled with the stems for periods of years have shown no apparent decrease in production in comparison with other trees. Certainly, there is a loss of fruit spurs, but apparently not great enough to cause a difference in the next year's crop.

THE SOUR CHERRY INDUSTRY IN MICHIGAN

Roy E. Marshall, East Lansing, Michigan

The commercial sour cherry industry of Michigan is chiefly developed in the counties along Lake Michigan and extends from the Indiana line to the Straits of Mackinaw. According to the last census, 70 per cent of the sour cherry trees of the state are in these counties, which fact strongly indicates that the lake shore counties contain from 90 to 95 per cent of the commercial acreage of Michigan. Kent is the only inland county producing cherries in large commercial quantities.

The Grand Traverse section, which is probably the best known cherry section of Michigan, has about 30 per cent of the total bearing acreage in the state and is the heaviest producing section. It consists for the most part of Grand Traverse, Benzie and Leelanaw counties and centers about Traverse City. This section is very rolling, in fact quite rugged in places, and in addition to Lake Michigan bounding it on the west and north, it has a number of other large bodies of water, such as Grand Traverse bay, Crystal lake, Lake Leelanaw and several smaller lakes. Though this section is the best known, it is the youngest in the extensive development of the commercial industry. Some commercial plantings existed thirty and more years ago, but the bulk of them are under twelve or fourteen years of age and the largest increase in acreage has taken place during the past ten years.

Southward along Lake Michigan, Manistee, Mason and Oceana counties comprise another section. Here the land is rolling, but not as rugged as the Grand Traverse section and the soil is of a heavier type. The plantings are rather young in Manistee county, but those in Oceana and Mason counties indicate an older cherry industry. In fact, Mason county does not have as large an acreage as it had ten years ago. Oceana county is by far the largest producer of the three. The acreage in this section is about half that of the Grand Traverse section.

The third important section extends from the Indiana line northward along the lake shore for about 70 miles, crossing parts of Berrien, Van Buren and Allegan counties. This is Michigan's most diversified fruit section, and, of the tree fruits, cherries rank below apples, pears and peaches in respect to acreage. Cherries have been grown commercially in this section for several decades and the acreage has increased and decreased several times, depending upon the relative profits derived from the various fruit crops. This section has about 15 per cent of the state's cherry acreage.

Grand Traverse has the largest acreage of any one county, amounting to about 13 per cent of the bearing trees in the state. A comprehensive idea of the geography of cherry growing in Michigan may be secured by

giving Grand Traverse county a weight of 100 and weighing the ten counties leading in acreage accordingly:

Grand Traverse	100	Van Buren	36
Benzie	73	Allegan	32
Oceana	70	Manistee	27
Leelanaw	60	Kent	20
Berrien	50	Mason	20

Why has there been a greater development of the sour cherry industry in the Grand Traverse region (which is in about the same latitude as Sturgeon Bay, Wisconsin, Ottawa, Canada, and Minneapolis, Minnesota,) than in the sections 100 to 200 miles farther south along Lake Michigan? Several factors must be considered. Much of the land in the vicinity of Traverse City is not well suited to general farming operations because of its topography, but it is satisfactory for orchard purposes. Earlier mention has been made of the location with respect to bodies of water which tends to provide a more equable temperature than would otherwise obtain. The average date of the last killing frost, May 10th, is the same for the Grand Traverse region as it is for Berrien and intervening lake shore counties, but the blossom buds are not as far advanced in the Grand Traverse county on May 10th as they are in Berrien, Van Buren or even Oceana counties, which accounts, in part, for the lesser amount of frost damage. Furthermore, there is less winter injury to either wood or bud in the northern section than in the others. These factors tend to substantiate the claim that the trees in the vicinity of Traverse City are more productive over a period of years than those farther south. It should also be stated that more successful market development has taken place in the Grand Traverse section than in southwestern Michigan. Cherries have been planted on low, flat lands of southwestern Michigan as well as on the relatively higher ones, but growers in that section now realize that cherry sites must be selected with fully as much care as peach sites, in so far as freedom from frosts is concerned. Future plantings in southwestern Michigan will, therefore, be made on more favorable sites and should thus tend to increase the average annual production of that section by avoiding much of the frost injury.

Michigan's greatest expansion in the sour cherry industry, in the immediate future at least, will be in Grand Traverse and Leelanau counties. Mr. W. A. McCool, manager of the Grand Traverse Packing Company, recently stated that the future expansion in that section would be in sour cherries rather than in apples and that fully 75,000 cherry trees would be planted in 1923. Thousands of acres of land, fully as good as that now planted, are available for future plantings. Still another factor is the difference of ten days in ripening between Traverse City and the Cherry Homes plantings in the extreme northern end of the Leelanau peninsula, thus providing a decidedly longer canning season than is available elsewhere in the state.

Montmorency is decidedly the most satisfactory variety for shipping and for the canning factory. In southwestern Michigan 50 to 60 per cent of the trees are of this variety and farther north it will make up 75 to

90 per cent of the production. It is larger and firmer, will hang on the trees much longer, thus providing a longer picking, canning and shipping season, than Early Richmond, and the trees are more productive. Early Richmond is of second importance, and is grown because it ripens about ten days ahead of Montmorency and thus provides a longer shipping and canning season. Morello is about ten days later than Montmorency. It is not grown extensively because the trees are too small and limited in bearing capacity and because of their susceptibility to leaf spot. Since Montmorency does not permit of extension of the canning season much beyond two weeks, we are particularly anxious to find late and early strains of this variety and believe that we will soon be successful in getting a strain that ripens one to two weeks later. In fact, there are several individual trees under observation at present that are later in maturing their fruits.

Planting distances vary from 16 to 22 and even 24 feet, with the average about 18 feet. Many well informed growers insist that 18 feet is not too close from the point of view of profits, but there is a general tendency to increase the distances in new plantings. We suggest 22 feet for Montmorency on the average soil type. Most of the cherry orchards are given frequent cultivations until after harvest when some (too few) of the growers sow cover crops of rye, oats, vetch, or, in southwestern Michigan, crimson clover. In the Grand Traverse section, some growers are putting their cherry orchards into sod because of the tendency of the soil to wash badly on the steeper hillsides. During the past year or two a few cherry growers have sown alfalfa in their orchards. This looks promising as a method of preventing orchard erosion, adding humus and cheapening production.

Cherries apparently do not respond to applications of quickly available nitrogenous fertilizers as readily as apples or peaches, but the demonstrations of the Michigan Agricultural College and the county agents have shown some very striking results. Nitrogen is most effective in increasing tree vigor and consequently yields, but we find it profitable to supplement the nitrogen with phosphorus to encourage a better growth of cover crop or grass mulch. We therefore recommend the application of two to three pounds of sulphate of ammonia or nitrate of soda and about four or five pounds of acid phosphate per tree in orchards where the annual growth is weak and the trees are apparently lacking in vigor. These materials should be broadcasted about the time the buds show green.

Michigan cherry growers usually practice a thinning out of small wood throughout the sides and tops of their bearing trees for the purpose of invigorating these parts and more particularly to admit sunlight to the interior and thus prevent the fruiting twigs in these parts from becoming unproductive and dying. Other practices may be desirable, but until we investigate further we are satisfied to continue this kind of pruning as a general practice. However, where the trees have been defoliated by leaf spot or where the annual growth is very short and all the fruit is being produced from lateral buds rather than from spurs, rather severe heading should accompany the thinning.

The cherry leaf spot is the most serious disease. It may completely defoliate the trees before the fruit reaches maturity and thus prevent its ripening. Cherry growers cannot recall a season when losses due to this disease were as serious as they have been in 1922.. It was serious in all parts of Michigan during the past season, but the northern sections suffered the heaviest losses. It is estimated that 50 per cent of the leaves dropped from trees in the Grand Traverse section and that the crop was cut short fully 25 per cent. There were thousands of leafless trees at harvest time. However, many cherry growers obtained absolute control of the leaf spot by spraying with lime-sulfur or with bordeaux. Professor W. C. Dutton of the department of horticulture at the college secured absolute control with either materials in his experimental plots located on the Grand Traverse peninsula. We prefer lime-sulfur because of the lesser amount of trouble involved in mixing and because we have some evidence that bordeaux reduces the size of the fruit more than life-sulfur.

Brown rot was quite serious in most sections during the past season. Aided by a heavy rainfall at the beginning of the Montmorency harvest, brown rot began to work rapidly in orchards which had not received late sprayings. The growers became alarmed and in an attempt to get the fruit off the trees before it rotted, piled it into the canneries faster than it could be handled. As was to be expected, the fruit rotted rapidly in the receiving rooms before the canners could take care of it. Some canners found it necessary to inspect each load of fruit and to pay on the basis of freedom from rot.

The spray schedule which the Michigan Agricultural College has recommended and which gave control in an epidemic year follows:

TIME OF APPLICATION	MATERIALS TO USE	DISEASE OR INSECT
Just before blossoms open	Lime-sulfur or bordeaux	Leaf spot; brown rot
Just after blossoms fall	Same plus arsenate of lead	Leaf spot; brown rot curculio; slugs
10 days or 2 weeks later	Same as above	Same
Immediately after harvest	Lime-sulfur or bordeaux	Leaf spot

Use lime-sulfur 1½ gallons to 50 gallons of water; bordeaux, 4-5-50 formula. Powdered arsenate of lead, 1 pound to 50 gallons of water.

Growers have not experienced difficulty in getting their crops harvested. They pay by the pound and the tourists from the cities form a considerable portion of the help. Cherries for shipment are picked with the stems intact, but for the canning factory the fruit is "milked" or pulled from the stems.

In the southwestern part of the state there is probably as much fruit shipped by boat and train and hauled out in auto trucks as is consumed by the local canning factories. Most of the fruit in Oceana county is sold to the canners, and fully 90 per cent of the crop in the Grand Traverse section is canned.

During the past summer some of the cherries from Berrien county were precooled before shipment, but it is doubtful if it would pay to build pre-

cooling plants for cherries alone unless they are intended primarily for cooling the small fruits and peaches. If they are available, precooling plants will undoubtedly aid in preventing market gluts and in making possible a wider distribution. Frequently, the daily pickings are greater than the market will absorb in one day without a reduction in price and under such circumstances the precooling plants are used to hold the surplus fruit off the market for a day or more.

According to a recent report of the State Canners Association, 18,170,000 pounds of sour cherries were put through the Michigan canning factories during the past season, which is more than three times the pack of five years ago. This amount probably represents about 75 per cent of the commercial production of the state. It is equivalent to 860,033 cases of the finished product, representing a value of $1,663,356. The average price paid the cherry growers was 6 cents a pound at the canning factory. Several of the canners have considerable quantities of unsold cherries in their warehouses, but they are moving out gradually. The canned product is sold mostly in the Central Freight Association territory.

There is need of more cooperation between the canner and the grower. The cherry producer must learn that he will profit in the long run by bringing only sound fruit to the factory and delivering it no faster than the canner is able to handle it properly. If the grower crowds the canner with fruit that is likely to go down with brown rot, the canner must stand the losses. Furthermore, the product is seldom one that is a credit to the locality. The canner, realizing that he must keep the good will of the producers, hesitates to tell a grower that he must cease picking for a day or two for fear that the grower will find another outlet for his fruit. A closer understanding of each other's problems must come if a locality is going to put out a product which will be a credit to grower and canner and, at the same time, bring maximum returns to both orchardist and canner.

Again, there is a great difference among canners as to what will not be accepted for canning. Some are not careful enough about their pack. They let a great many more brown rot cherries pass over the sorting belts than other canners who are trying to build up a reputation for the section. I know of a case where immature cherries picked from trees defoliated by leaf spot were accepted by one canner after they had been turned down by a neighboring one. Furthermore, it is almost impossible for pure food authorities to condemn such fruit because the fruit itself, though its quality be poor, is not diseased—it grew on diseased trees. The canners must work together to establish higher standards and to make the pack of a section as uniform as possible.

The Grand Traverse Packing Company at Traverse City built a plant to freeze cherries in 50 gallon barrels the past season and operated it to capacity with apparently very satisfactory results. The cherries were received at their branch plant in Benzie county where they were pitted and run into the barrels and then shipped to Traverse City, where the fruit was frozen within a few hours. This product has been moving out to pie bakers. Traverse growers are enthusiastic over the future outlook for this manner of handling the crop.

Advertising has not been attempted so far, but plans are on foot in the Grand Traverse section to launch a campaign to increase the consumption of canned cherries.

It would be much more satisfactory if not only the Michigan organizations, but the Sturgeon Bay people as well, could unite in such an undertaking, because what will be of benefit to one will also benefit the other and the money could be made to produce much better results if wisely expended in such a manner.

By way of summary, it is evident that the so-called fruit belt of Michigan will continue to be a big factor in the commercial production of both fresh cherries and the canned product, and that the Grand Traverse section may be expected to materially increase its output of canned cherries and the frozen product in 50 gallon barrels. Furthermore, the selection of sites freer from spring frosts for future plantings, the use of nitrogenous fertilizers and the adoption of better spraying practices will operate to increase production. Steps must be taken to enlist the support of all growers and canners in the improvement and standardization of the cannery pack and to obtain greater and more thorough distribution of both fresh fruit and the canned products.

THE PLUM IN THE EAST

Dr. U. P. Hedrick, New York Experiment Station, Geneva, New York

The plum with its many varieties and great adaptations is not receiving the attention it deserves in the fruit regions of eastern America. There are two reasons for its neglect. California has taken the lead in growing plums and puts on the markets of the country a great diversity of handsome fruits, with which in appearance, at least, the products of eastern orchards cannot compete. The second reason for the neglect of this fruit in the east is the prevalence of curculio and brown rot, scourges which take so great toll that the crop can be profitably grown only with constant and expensive warfare. Well grown, there can be no doubt as to the demand for plums in the east, as figures from western distributors show that from seven to ten million dollars' worth of plums and prunes are shipped east from the Pacific slope annually.

Four groups of plums are grown in America—the Domesticas, the Institias or Damsons, the Trifloras or Japanese, and a very diverse group of varieties evolved from several wild species native to the country. Of these, but three groups are represented in the commercial orchards of the east.

Domestica or European Plums

Domestica plums are represented in eastern America by several groups, quite distinct in the characters which make them desirable for the purposes to which plums are put, and in their adaptabilities to soil and climate. Attention is called to the fact that the plum does not hold in eastern America the relative importance that it does in Europe, since it is here grown less than the apple, peach or cherry, while in Europe the plum holds second or at least third place among tree fruits. The restricted culture of this fruit in eastern America is due to the fact that most of its varieties are not well adapted to the American environment. Thus, in the region under consideration, Domestica plums are grown well only in favored locations on the Atlantic seaboard, and in the Great Lakes region.

Of the Domestica plums commonly grown in the east, in quality, at least, the Reine Claudes are most notable. The dozen or more best sorts in quality belong here. All of its varieties are sweet, but not too sweet, and each has a distinctive sweetness; the flesh of all is rich and delicate; all have an abundance of juice, and none are watery as are the fruits of many native sorts; while not brilliant in color, at their best the fruits of most of the varieties are attractive, the colors ranging through the greens and yellows, usually marbled, with tints of white and crimson. In no other group are the characters which please mingled in nicer proportions. Reine Claude and Bavay are the two best varieties of the group. The trees of both of these plums bear young, are productive, and when the crop is thinned, the fruits are large and handsome. Unfortunately, the trees are not hardy, robust, nor long-lived.

The prunes constitute the second group of Domesticas. The fruits of the prunes are oval shaped, usually purple, with firm, long-keeping flesh, which dries into a cured fruit. In eastern America prunes are repre-

sented in commercial orchards only by the Italian and German. The prune flora of the east is much too meagre, and of the sorts known, Agen and Imperial Epineuse, at least, should be added to the list as sorts worthy of general cultivation. The German and Italian prunes are very popular as culinary fruits, and are without question the best of all plums for culinary purposes. Agen and Imperial Epineuse are, in the east at least, dessert prunes, but are nearly as desirable for culinary purposes as Italian and German.

The Yellow Egg group is composed of varieties with large and handsome plums. Out of a dozen or more of the Yellow Egg varieties only two, Yellow Egg and Golden Drop, are grown in eastern America. Yellow Egg is fit only for the kitchen and is none too good for culinary purposes. Golden Drop produces large, handsome, well flavored fruits, but the trees thrive in but few places; they lack vigor, are slow in coming in bearing, and are subject to many ills. There is great opportunity to improve this group of plums by crossing with sorts which will give better trees and better quality in the fruit.

Diamond, Monarch, Grand Duke, Quakenboss and a few similar but less important sorts constitute another group. The fruits of all these have thick skin, heavy bloom, firm flesh, clinging stones, and all are poor in quality. Their greatest asset is that they ship well, although the fruits of all are attractive in appearance and the trees are hardy, thrifty, and productive. All are largely grown in the east, and of all, Monarch is the best; its rich purple color, fair quality, and excellent tree characters give it a place among the best commercial sorts. Grand Duke is a favorite shipping plum because of its large size, handsome color, and firm, meaty flesh. The trees of Grand Duke are poor in the nursery, but make very good orchard plants, as they bear regularly, abundantly and hold the crop well. Arch Duke bears fruits nearly as large and of the same color as those of Grand Duke, but they are higher in quality, the stone is freer and they ripen earlier. Quackenboss does not equal the three sorts named in fruit characters and the trees are unproductive. The fruits of Diamond are attractive, but are wretchedly poor in quality, and the tree characters are none too good.

The Lombard group is best represented in the east by Lombard, Bradshaw, Pond, and Field. The fruits of this group differ from those of the preceding one in being reddish or mottled, and are smaller in size. The tree characters of varieties of Lombard-like plums are excellent, and were the quality of the fruit better, they would be dominant in eastern America. The quality of the fruits of all the plums in this group is very poor. Lombard is the most grown of the several varieties named because of hardiness, productiveness, regularity in bearing and freedom from curculio. It would be the plum "for the millions" were the quality of the fruit better. Bradshaw is most deserving of culture of all. The trees are large, well-formed, bear regularly and heavily, are hardy, robust, healthy and suffer little from San Jose scale. Field, offspring of Bradshaw, differs chiefly in being a little earlier. Pond is preeminent among plums for the large size and attractive color of its fruits. It is, however, a handsome humbug, as the fruits are far below the mark in quality.

The Damsons

The Damsons, or Insititia plums, are second in importance to the Domesticas in eastern America. Shropshire is the best of the Damsons, and its trees are hardly surpassed among all tree-fruits for productivity and regularity in bearing. The fruits of the French surpass those of all other Damsons in size, the flesh is nearly free from the stone, and the quality is better than that of any other Damson. Commercially, the Damsons are more important in eastern America now than ever before.

Closely related to the Damsons are the Mirabelles, a group of plums hardly known in this country, but accorded first place among all plums in many parts of Europe, where they are used, in the fresh state, for prunes, preserves, jellies, jams, candies and marmalades. In size the fruits of the Mirabelles are a little larger than those of the common Damsons and not quite so large as those of the Green Gage plums. Several varieties of the Mirabelles grow well on the grounds of the New York Agricultural Experiment Station, and would thrive wherever Damsons are grown in America. This group of plums is much neglected in the new world. Experiment stations and plum growers should push its culture.

Triflora or Japanese Plums

The Japanese plums have been overpraised and overplanted in eastern America, and with the exception of a few varieties, are hardly worth planting in this region. Some qualities, however, commend them to both commercial and amateur growers. Thus, the Japanese plums have a greater range of adaptability to soil and climate than other plums, the trees are very productive, and most of the Japanese varieties are free from black knot, leaf blight, and curculio. Their faults are as marked as their merits, chief of which are: early blooming, susceptibility to brown-rot, tenderness to cold, poor quality, clinging stones, and soft flesh, by reason of which they never keep or ship well. Abundance and Burbank are the two Japanese plums commonly planted in eastern orchards and are the only sorts worth planting in commercial orchards. Red June and October are esteemed for home orchards. Of the two commonly planted sorts, Abundance is adapted to a greater diversity of soils, bears more heavily and regularly, but the fruits do not keep as well, are more subject to brown-rot, and mature more unevenly than do those of Burbank. On the other hand, the fruits of Burbank are larger, of better quality, keep and ship better, ripen a little earlier, and as has been said, rot less. Burbank should have the preference in most parts of eastern America.

Native Plums

Varieties of native plums have not made a conspicuous place for themselves in any part of eastern America. They ought to be more planted because of hardiness to cold and heat, freedom from disease, and to extend the range of varieties and color and taste in this fruit. Native sorts should have value in the east for sauces, jellies, plum butter, and all culinary purposes.

Hybrid Plums

A great number of Hybrids between Triflora, Simonii, and the several species of native plums are now offered by nurserymen, but as yet are little planted in eastern America. Most of these hybrids produce attractive fruits, but nearly all show weaknesses in tree, and the fruits of few, if any, can be called high in quality, all having a distinctive and peculiar flesh to which one must become accustomed. The best of these plums, nearly all from Luther Burbank, are Apple, America, Bartlett, Climax, Golden, Juicy, Shiro, Wixon, Formosa and Santa Rosa. All of these are growing under the writer's eyes at the New York Agricultural Experiment Station, and all are disappointments in one way or another. Perhaps the greatest disappointment is that one prepares his palate, in reading the descriptions of the originators, for melting flesh, juice of nectar, and flavor of ambrosia, but finds instead soft or stringy pulp, watery juice and a foreign and often disagreeable taste.

Soils for Plums

My paper is to be concerned mostly with groups and varieties, but I want to include some statements in regard to eastern plum culture, trite as I know they will be to veteran fruit-growers. Plums are grown on most soils suited to general farm products in eastern regions where the climate permits plum-culture. From this it is seen that plums thrive on a great diversity of soils, and one may make the general statement, that, given good tillage, some sort of plum can be grown commercially in every eastern fruit soil. Yet species of plums have very decided soil preferences.

The Domesticas and Damsons do best on clays and loams. On such soils the trees are largest, most productive, and the fruits are best in size, appearance and quality. The Japanese plums do best on light loams or sands, and in general thrive wherever the peach is well grown. Some variety of the several species of the native plum can probably be found for every soil and climatic condition suitable for any sort of agriculture in eastern America. Every owner of a farm and garden can grow a native plum if he chooses.

Stocks

A discussion of stocks naturally follows that of soils. The plum is well grown in America on at least six stocks, and the practices of nurserymen are diverse, depending on the cost of stocks, ease of budding, and the adaptability of the tree to the stock. The New York Agricultural Experiment Station has most of the leading plums growing on six stocks in a test of stocks. The experiment has been running eleven years. On the grounds of this station Myrobalan is unquestionably the best general stock for plums. It seems to suit nearly all varieties of all groups better than any other stock. Fortunately, it is the cheapest and most commonly used of all stocks. The St. Julien stock is second best, after which comes, in order named, Mariana, the peach, Americana, and seedlings of Domestica plums. The latter would have higher rank were it not for the fact that they sucker so badly that proper cultivation is hardly possible on this stock; moreover, some of the species will not take on the Domestica stocks.

Top-Working Plums

In horticultural literature recommendations to top-work plums are frequent, but in eastern attempts at top-working the failures are much more conspicuous than the successes. If one attempts to top-work, probably Lombard is the best stock and probably he will find it better to bud in late summer, although some recommend grafting in late spring. One thing is certain, the earlier in the life of the trees the budding or grafting is done, the better.

Sterility in Plums

Eastern growers find that some plums do not set fruit even though the trees blossom abundantly. The cause of infertility is most often the impotency of pollen on the pistils of the same variety. The remedy for such self-sterility, as all know, is to plant in close proximity varieties that will cross pollinate. Self-sterility is a matter of minor importance in eastern America.

Culture

Perhaps a few general statements may be offered as to culture of the plum in the east, although the care of the fruit differs so little from that of tree-fruits in general that few fruit growers will be interested in cultural notes.

Plums in the east are far too often set too close. The distance should depend upon the soil and the variety. A rod or eighteen feet is the proper distance in most parts of eastern America for all excepting the very wide-spreading sorts. These distances would be too close were it not best to cut down the trees when the orchard begins to decline, which in most localities is at the age of from twenty to thirty years. In eastern America plum trees are usually set two years from the bud; they are headed low with the head composed of from four to five main branches, and a central leader for the Domesticas, Damsons and natives; a vase shaped tree is considered better for most of the Japanese sorts. Japanese plums, especially Burbank and Abundance, do best when heavily pruned; other sorts require comparatively little pruning. Many plum growers head back their trees every year; this procedure is of doubtful value.

In common with all tree-fruits, plums do best under tillage in this region. Tillage consists in plowing in the spring, followed by frequent cultivation until August, at which time a cover crop of clover, oats or barley, cowhorn turnips or a combination of some of these is planted. Despite the fact that plums want a rich soil, it is to be feared that most of the fertilizers used for this fruit are wasted. The writer speaks, however, from experience on heavy soils where it is certain that all fertilizers applied to plums are wasted. On light sandy soils it is probable that nitrogen, at least, would benefit both tree and fruit. Thinning the crop is a regular practice in growing the Domesticas and Japanese sorts. The Damsons need no thinning. Packing, marketing, and markets is another story and a long one.

PLUM GROWING IN THE CENTRAL STATES

Benjamin Wallace Douglass, Trevlac, Indiana

If we except a few favored locations, Central States plum growing has been in the past largely a mixture of romance and superstition.

It would probably be difficult to trace the start of plum culture in this section, but for my own purposes, and without knowing anything definite about it, I have built up a little romance of my own concerning our first plum trees. I have enjoyed thinking that the first plums that came into the early settlements were brought here by that hardy group of pioneers, the Jesuits. I like to think of some sturdy priest carrying his religion and his trees in the same canoe down the long waterway of the Great Lakes. It does not matter that his religion and his fruit were not the varieties of those commodities that I would select for myself, but the mere fact that he was a beginner, that he had a vision of a future nation, has always appealed to me. In support of such a theory one may find today certain very old plum trees growing at Mackinac Island and at other settlements where the Jesuits made their first stand against the wilderness. Each year as I return I look upon some of these old trees in the full belief that they are at least descendants of those brought by the first white men and I regard them with the same respect that I give to the splendid bronze statue of Father Marquette standing guard before old Fort Mackinaw. I have never too closely investigated the particular variety of plums which these old trees bear. Doubtless my friend Taft could tell me, but, lest he might shatter one of my pet romances, I have never asked him. In many parts of the Central States the plum industry, if we may dignify it by such a term, rests upon another romance—one that we can investigate fearlessly. Hedrick, in his splendid monograph on the plums of New York, records the following:

"About 1820, M. E. McChance, who lived near Nashville, Tennessee, shot a wild goose on his farm; his wife, in dressing the goose, found a plum seed in the craw, which, planted in the garden, produced the Wild Goose tree."

During a rather extended study of the origin of the varieties of fruits, I do not think that I ever found anything which compares with that for pure romance. What a loss it would have been if that particular goose had been shot by some city hunter who would have thrown the plum seed in the ash can. At any rate, the variety which originated under such unusual circumstances has played a prominent part in our Central West horticulture.

I said at the beginning that superstition had played a part in plum development. Most of our plum plantings in this section have not been systematic, but have been incidental attempts on the part of the farmer to supply his family with fresh fruit. From somewhere, out of the air, or the Black Forest, or Grimms' Fairy Tales, came the notion that plums must always be planted in multiples of seven—the ideal plan being to set out seven trees in a circle. Several farmer-fruit growers have told me in confidence that they really did not think there was "anything in it," but they did not like to take a chance. Another man once told me that he had "good luck" with plums until one of the trees died, break-

ing the magic circle. Since that time the remaining six trees had failed miserably in the matter of crops. Doubtless the tree that died had been the pollenizer for the whole outfit, but it was beyond my ability to explain such a situation to a grower of that ilk.

I was once accused of being superstitious about plums myself. While visiting a fruit grower whose methods might serve as a horrible example to anyone contemplating a horticultural career, I was invited to look at his plum trees. These I found to be located in the hog lot. The method of gathering them consisted in shaking them into the layer of lob-lolly which covered the surface of the soil and then picking them out and wiping them carefully on one's sleeve. I assured the grower that I did not care for plums. "What's the matter," he said, "are you superstitious about a little dirt?" I assured him that I was.

As a general thing, European plums have never been a commercial success in the Middle West. It is true that some varieties, such as Lombard, Bradshaw and Green Gage, will grow and bear fruit with us, but, as a rule, they are not dependable and often when they do bear fruit it is of a quality that does not compare with that of similar sorts grown in more favored localities.

As an exception to the above, I would say that in parts of Michigan one will find plums of as fine quality as can be produced any place on this earth. Perhaps I should say, any place in America, for there are still several places on the earth where they grow plums that I have not visited. Anyhow, the latter statement is strong enough, for we are not likely to compete with foreign plums and if we should I am quite sure that we could secure a tariff that would protect us.

I am indebted to Prof. L. R. Taft, of Lansing, Michigan, for the following detailed statement of the plum industry in his state—and with him it really is an industry:

"Of the Japanese varieties, Burbank is most generally grown and is considered the most reliable, but in some sections Red June has proven very profitable as an early sort. Abundance is still grown to some extent.

"Of the European sorts, Lombard is still most generally planted, and, of course, it is a very productive variety, but owing to the fact that the market is generally filled with peaches and with this and other varieties of plums at the time it ripens, the price is generally lower than is secured for other sorts.

"Bradshaw and Pond are grown to some extent, but both of these, as well as the Lombard, are inclined to rot if weather conditions favor this disease, and hence they are not very extensively planted, especially as they are late in coming into bearing. Of the other early European sorts, Guii is perhaps most extensively grown. It is generally quite productive, and although the fruit is not of the highest quality, it answers well for canning. In seasons when brown rot is prevalent very careful spraying and dusting are required to save the crop.

"Our plum growers are really getting the most money from the large late blue varieties. The Grand Duke, the Arch Duke and the Black Diamond are held in high esteem. Monarch, in many respects, surpasses these kinds, but the trees are not so hardy and it should only be grown where conditions are quite favorable.

"Shropshire and French Damsons are very largely grown and usually bring about twice as much per bushel as the common varieties. They are little troubled by insects and fungi and can be grown with less care than other sorts. The prunes each year receive more attention. The trees, as a rule, are not very much troubled by brown rot, but the foliage is quite subject to the attack of the leaf spot disease.

"Some of the varieties of American origin are grown in the north part of the state where the climate is too severe for those of Japanese or European origin, but they are not planted to any great extent.

"At Eveline Orchards (Professor Taft's own orchard), we have about fifty trees each of Red June and Burbank which seldom fail to give a good crop and they have been quite profitable, as we have sold a large part of the crop each year to resorters. Most of the Red June plums have been taken as fast as they ripen at 25 cents per quart. We have had very little trouble with curculio and other insects and have readily controlled the leaf spot disease with commercial lime sulphur. Since we do not have any scale insects in our section, we do not make a dormant application, but use the commercial brands at the rate of one part to forty or fifty parts of water and spray often enough to keep the trees covered with the spray. We make the first application when the color begins to show in the buds. In the first three sprays we add arsenate of lead as an insecticide.

"The brown rot has seldom done much harm, but we did lose a few of the Guii this year. We generally have to take off from one-half to three-quarters of the crop to prevent the breaking down of the trees and, of course, this thinning of the fruit aids us in thorough spraying. However, we have found it advisable to make one or two applications of sulphur dust between the time when it is necessary to stop applying the spray and the harvesting of the fruit."

As a comparison between Michigan conditions and conditions as they exist over the greater part of the area I am discussing, I am going to tell you something of our experience with plums in our own orchards. I am doing this, not because of any great success we have had with plums, but simply because I think that our conditions will fit those of most other Central West states outside of Michigan and perhaps some parts of Wisconsin.

To start with, we have done but little with European sorts. Plums of this class are sometimes grown in my state, Indiana, with good success, but their general record is against them. Lombard and Green Gage are more often tried than any others and I have both at Hickory Hill. Neither of them is worth a whoop as a market plum—in fact, in ten years two trees of each sort have never produced more than we could use at home. Had we produced enough to sell they would not have found a ready market, as they are inferior in quality. Damsons, on the other hand, are fairly reliable, are of good quality and nearly always bring a fair price. Probably they should be more widely planted throughout our area.

Japanese sorts have been widely planted and it was on varieties of this class that we pinned our faith when the first plum blocks were set at Hickory Hill. Our faith has been fairly well justified, for they have been moderately productive, though not always profitable.

Burbank grew vigorously and supported large crops of fruit whenever the weather was kind to us—which was not always. Unfortunately, our market does not care for the Burbank, and I must say that I do not blame the market. For my own use I prefer the Abundance as a fruit to eat right from the tree. While we harvest them slightly before they have reached their best eating condition, I always manage to leave a tree or two that I can visit at the end of the day for refreshment. When they are at their best I not infrequently have business in that part of the orchard at any and all times of the day.

Our one most profitable Japanese variety was the Red June. While we did not have the resort trade that pays so lavishly for Professor Taft's plums, we did establish the record price of eight dollars a bushel for this variety. I think the reason for this is that the Red June ripens before any of the fine European sorts are on the market and at a time when the public will pay almost any price for fancy fruit. Fruit that brought that price was, of course, not packed in bushels, but in one peck Climax baskets. I have intentionally used the past tense in connection with our Red Junes, for they departed from us during the big spring freeze in 1921. This freeze seemed to find the trees in a very tender condition and they were all killed to the ground. A very few have sprouted from the root, but almost none have grown from above the bud.

During the same season which killed the Red Junes we had a few plums on trees of the America variety, a sort that should have more than passing notice. The America is one of Burbank's "creations," having been grown from a seed of Robinson fertilized by Abundance. It has inherited the vigor of its native parent, but the acid quality of the fruit has been tempered by the Japanese blood. As a result, we have a variety that is tremendously productive, healthy, good in quality for a plum of its class and remarkably hardy. Combined with these qualities is a tendency to bear good crops at an early age. Some of our trees produced as high as a crate (24 quarts) of plums when the trees were three years old. Since that time they have been consistent bearers and have seldom lost a crop during a spring frost. To offset its good qualities we must remember that it is almost strictly a culinary plum. Its eating qualities are not such as to make it compete with even the most ordinary European sorts. Also, with us, it comes on the market at the same time that the old Wild Goose arrives—and the Wild Goose comes in large flocks. Consequently, the America has never been as profitable as it should be if its jelly making quality were fully realized by the Central States housewife. The Wild Goose variety has had a rather confusing history. Farmers have a penchant for growing fruit from seed and many seedlings of the Wild Goose have been grown in door-yards. A good portion of these resemble the parent tree to a very great extent and have served to distribute many distinct kinds under the one name. As a result, nearly all small red plums that ripen early in summer reach the market under the title of Wild Goose. Also, plums of this type are so universally successful under conditions of neglect that they are grown by farmers who can not grow any other sort of fruit. This fact accounts for the general flooding of our markets with a more or less mixed variety of red plums.

Gold, Mammoth Gold and Early Gold are sorts still on probation, with a chance that one or more of them will prove very desirable.

Our worst insect has been, of course, the curculio, which we control either with dusting or by using arsenate of lead in the spray material. Commercial lime sulphur has not been popular as a plum spray with us and we still prefer to use the self-boiled lime sulphur. By applying three sprays, one before the bloom and two after, we have held our brown rot in check and have been but little troubled with the shot hole fungus. Unfortunately, in the past two years we have suffered a great deal from the bacterial leaf spot *(Bacterium prun.)*. Whether this will ultimately put us out of the plum business or whether it will yield to increased doses of nitrate remains to be seen. Black knot has not been a serious disease with us, probably because we have grown but few European varieties. With a proper selection of varieties, there is no reason why more plums should not be grown all through the Central States. Whether these plums would find a market in the large cities is a doubtful question, but certainly many more could be used in local markets.

There is no reason why the general farmer could not add a trifle to his income by growing a few plum trees to supply his neighbors with fruit. To be successful, of course, he must realize that plums, like corn, require cultivation, that they must be sprayed and that enough varieties must be planted together to insure pollenation. When he does realize these few simple, scientific facts and forgets the element of superstition that has shrouded plums in the past, we may expect more development of the plum industry in our section. It may not be, and probably will not be, a localized development, but, instead, will be diffused over the greater part of our "good farming" country. If such a development comes, then the general farmer will be able to share with the fruit grower one of the keenest joys of spring. Even if he has no crop of fruit he will still remember a certain dewy morning in mid-April when a fragrant breeze crept in at his open window and told him that the plum trees were in bloom.

PRUNE GROWING ON THE PACIFIC COAST

By A. H. Hendrickson, Assistant Professor of Pomology, University of California, Berkeley, California

The growing of prunes on the Pacific coast had its inception in 1856 near San Jose, California, when Louis Pellier, a French sailor, brought to this country a bundle of scions of the Prune d'Agen, later known as the French or Petite prune. The region proved to be adapted to this product and the industry began to grow. It was not, however, until about 1870, shortly after the completion of the Central and Union Pacific railroads, that it assumed commercial importance. Since that time each decade has shown marked increase in production and in new plantings. In the Pacific Northwest, Henry Miller is said to have planted the first prune tree near Milwaukee, Oregon, about 1860. The first commercial orchard in Oregon was planted near Portland by Dr. J. R. Caldwell about 1870. Dr. N. G. Blacklock planted an orchard of ten acres in southeastern Washington in 1882.

Although many plums have the term "prune" included as a part of the variety name, they are not prunes in the sense in which this term is used on the Pacific coast. The term prune is used for those varieties of plums belonging to the Domestica group which are capable of being dried without fermentation at the pit. The flesh is firm, high in sugar content and of fine texture and flavor. Other varieties of plums are too soft and watery and when dried are little more than skin and pit; or, they are lacking in sugar content and must be dried by cutting in halves as described elsewhere in this paper. The principal varieties usually included under the general designation of "prunes" are the French, Italian (Fellenburg) Sugar, Imperial and Robe de Sergeant.

Perhaps nowhere does the prune suffer so little from severe or unfavorable climatic conditions as in the sheltered valleys of California, Oregon, Washington and Idaho. The long, warm, clear summer months bring the fruit to maturity with a high sugar content, and mild winters are favorable to long life and productiveness of the trees without serious damage from the various forms of winter injury. The group of Domestica plums to which the prune belongs has not proven to be particularly hardy to severe winter weather, nor resistant to various troubles which follow. That the Pacific Coast states are adapted to this tree is evidenced by scores of orchards having trees thirty to forty years old in prime condition of productiveness.

Principal Varieties Grown

Despite the introduction of varieties other than the Prune d'Agen, and the efforts of individual growers who have discovered new and promising sorts, the whole industry is largely developed around two varieties. These are the Prune d'Agen, or French prune, in California and the Italian, or Fellenburg, in the states to the north. The French prune is also grown to some extent in these latter states. Perhaps the popularity of the French prune in California is due to its cosmopolitan adaptability and the high quality of the dried product. The tree is remarkable for its

regularity of bearing and the vigor of its growth. By means of different rootstocks, such as the myrobalan, the peach and the almond, it has been adapted to a wide range of soils and to sections varying greatly in available water for irrigation. Again, its ease of handling in the drying yards or evaporators has made it a favorite with all growers.

Other varieties may be mentioned as having challenged the supremacy of the French prune. One of the chief among these is the Robe de Sergeant, which is another importation from France. Some confusion exists as to the nomenclature of this variety. It was introduced as a prune grown in the Agen district of France, but as grown in California it is a distinct variety. The tree is not so hardy or vigorous as the French prune; the foliage has a much darker green color and the fruit is dis-

Fig. 1—For basin irrigation each tree is enclosed by ridges on four sides. The ridger is usually pulled by a tractor and the gaps in the cross-ridge filled by the small scraper all in one operation.

tinctly blue instead of purple. In the drying yards considerable difficulty is sometimes experienced with this variety because of the tenderness of the skin and the rather soft texture of the flesh. When dried, however, the product closely resembles the French prune and is sold as such. The habit of shy bearing, noticeable in some orchards, has been definitely traced to self-sterility. It is a variety of considerable importance and quite widely planted in certain districts in the Sacramento valley of California.

The Imperial Epineuse or Clairac Mammoth, commonly called the Imperial, is another variety imported from France. It is chiefly notable for its large size. Inasmuch as dried prunes are sold on a size basis, it was thought this variety would supplant the French. The tree, however, is

not as strong or vigorous as the French and seems to enter a stage of decline at a comparatively early age. Although it blossoms prolifically, the resulting crops are often very meager. This fault being due to self-sterility may be corrected to some extent by interplanting with either the French or the Sugar varieties. However, other factors also undoubtedly influence the bearing of this variety. It seems to be very particular as regards the soil upon which it grows. The blossoms, furthermore, are often seriously injured by the pear thrips *(Euthrips pyri)* when neighboring French prunes are but little damaged. Only a comparatively limited amount of new plantings of this variety are being set out.

Another variety of local origin has become of commercial importance in the past decade. This is the Sugar prune introduced by Luther Bur-

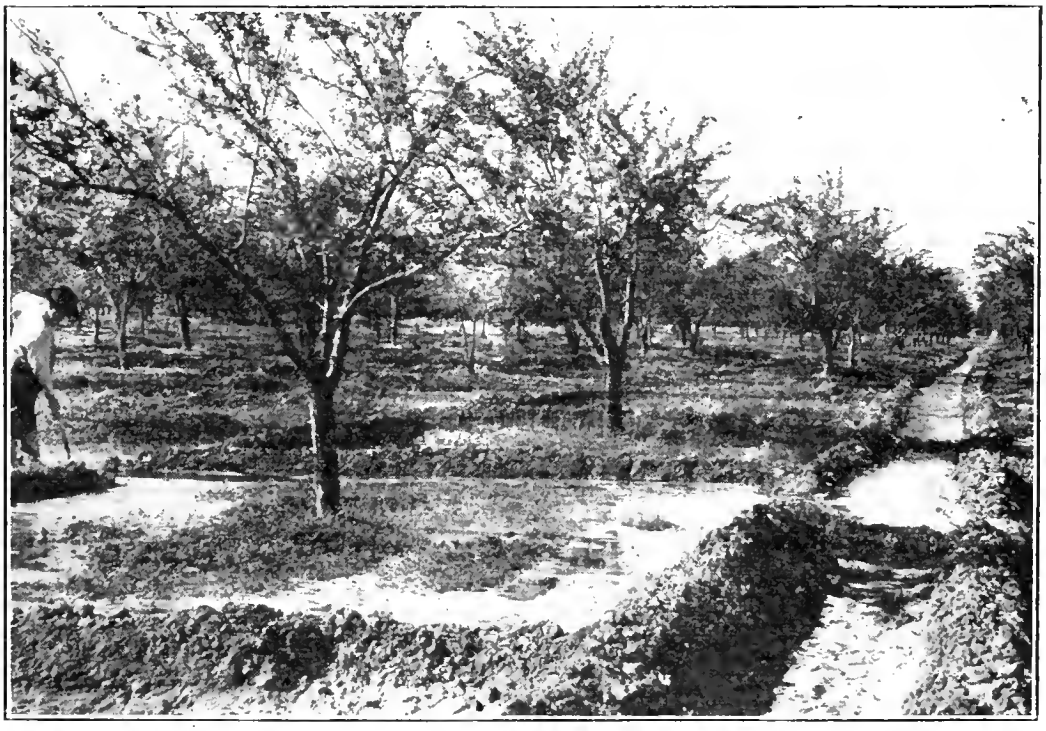


Fig. 2—The winter rainfall is sometimes supplemented by irrigation in early spring. This photograph shows one common method of applying the water.

bank in 1898. The Sugar is known for its heavy production. The wood of the tree, however, is very brittle and breaks easily under heavy loads, which necessitates a system of severe pruning to reduce the loss from breakage. Another disadvantage of this variety is its tendency to alternate bearing in many sections. The fruit, however, matures early and sun drying in regions of early rainfall is thereby facilitated. The character of the flesh in the dried product is inclined to be coarse and stringy and in general not of the high quality of the French varieties.

Other varieties have been grown from time to time, but such factors as erratic bearing and susceptibility to disease or insect injury have largely caused them to be abandoned. Among these may be mentioned the Silver

prune. This variety is still grown to a limited extent. It is often sold on the markets as a light colored prune. The yellow or golden color of the product is due to the sulphuring process before drying. Limited amounts of dried plums are also marketed each year. In general, these are usually cut in halves, the pit removed, and given a light sulphuring before drying. The varieties mostly used for this purpose are the large sorts, such as Grand Duke, Pond, Giant and President.

At the present time the only meritorious variety or strain of the typical prune is a variety grown under various names, but commonly known as the "Coates 1418." The variety is reputed to be a bud sport of the French prune which was propagated and introduced by Leonard Coates of Morgan Hill, California. However, there is some doubt as to the authenticity of the origin of this variety, the original tree having died before the variety was brought into prominence. The tree and fruit characters are similar to the French prune, except that the fruit has a large, rough pit. This variety is being propagated and set out rather extensively at the present time.

Curiously enough, the French prune, which is so popular in California, occupies a place of comparatively minor importance in the Pacific Northwest. This section is extending northward from the central part of Oregon and including the principal fruit sections of Oregon, Washington and Idaho seems to be best adapted to the Italian, or Fellenburg. This variety under favorable conditions is a thrifty grower and a regular and heavy producer. On uncongenial soils, however, poor crops may predominate. In addition to being grown for drying, a considerable portion of the crop of this variety is shipped east as fresh fruit. The peculiar combination of qualities which enable it to either be dried or shipped as fresh fruit has added to its popularity to a considerable degree. The dried product usually runs to large sizes of well-flavored prunes of excellent appearance and texture and keeping quality. The flavor is somewhat more tart than the sweet prunes in California. The French prune, or Petite as it is called in Oregon, is chiefly criticized in that section on account of its small size.

The Italian prunes for shipping are produced chiefly in the eastern parts of Oregon and Washington and in southern Idaho. In the western sections, notably the Willamette valley and parts of the Puget Sound region of the first named states, the principal use of this fruit is for making prunes.

Rootstocks

Prunes are grown on several kinds of rootstocks. The principal ones now being used are the myrobalan, peach and almond, arranged in the approximate order of importance. Occasionally orchards may be found on other stocks, principally the Marianna, St. Julien and Mussel. The native plums, as well as the Domestica stocks, were early discarded, largely because of excessive sprouting from the roots. At the present time myrobalan is chiefly favored in California, although there has been some difficulty in securing sufficient myrobalan seedlings for this purpose. The peach and almond are still used to a considerable extent, but do not predominate as they did twenty or thirty years ago. In the Northwest

the peach is used extensively as the rootstock for prunes. The myrobalan is particularly adapted to moist or heavy soils, especially where there may be too much water during a portion of the year. The peach and almond are generally used on the shallow dry or gravelly soils. The almond is avoided largely because of its extreme susceptibility to crown gall. Furthermore, the peach has been found to be as satisfactory as the almond for the shallow soils in some of the foothill areas. The fruit after it is dried shows no differences due to the rootstock, but minor differences may be seen in the trees. It has generally been observed that prune trees on almond root eventually grows to a larger size than those on either myrobalan or peach. The fruit is also held by some observers to be larger on almond root than on either of the other two, but on this

Fig. 3—Many prune growers rent bees and place them in orchards during the blooming season. Marked increases in crops have been secured by this method.

point there is no clear evidence. Prune trees on peach root usually leaf out earlier in the spring and the leaves maintain a lighter green color throughout the season than do trees on the other stocks.

Culture

Clean cultivation with cover crops during the fall and winter is the general practice employed in prune orchards, except in a few cases in the irrigated districts of Washington and Idaho. The usual practice is to plow in the spring and then cultivate at rather frequent intervals during the growing months.

Irrigation is practiced in most sections except in parts of western Washington and Oregon where late spring rains make this practice unneces-

sary. The amount and time of application of irrigation water, where used, varies so greatly it is impracticable to give the general practice here. In general, it varies directly with the cost and ease of applying the water. In some of the irrigated sections of Idaho and Washington where water is supplied by gravity under a comparatively low cost the practice is to irrigate in small furrows or corrugations every two or three weeks. In California the practice is to irrigate in furrows or basins on an average of from two to four times per season. In sections where cost of water is high, as, for example, in the Santa Clara valley of California, one irrigation before picking and one immediately after picking is usually considered sufficient. This practice, of course, is varied somewhat, according to the winter rainfall. Experimental evidence shows that when the winter rains have moistened the soil to a depth of from six to eight feet, one irrigation late in June and another in late September are ample to supply the needs of the tree, and to secure regular, profitable crops.

Many orchards, however, are grown entirely without irrigation. The yield in these orchards is usually below the average and the trees often suffer severely when the winter's rainfall is scanty.

Pollination

Growers on the Pacific coast are well aware of the importance of cross-pollination where necessary, and particularly of the value of honey bees in distributing pollen among the self-fertile varieties. Remarkable increases in yield have been obtained by the use of one colony of bees to the acre. It is an established practice in many sections in California to rent bees and place them in the orchard during the blossoming season. The principal varieties now being grown are self-fertile. Among these are French, Italian and Sugar. The self-sterile varieties are the Robe de Sergeant, Imperial and Silver.

Pruning Young Trees

The practice with young trees is to cut the newly set tree to about twenty-six inches. From this whip three to five scaffold branches are formed. No further cutting is necessary with the French variety, although many growers prefer to head the scaffold branches of the Sugar, Italian and Imperial at approximately four to five feet from the ground so that the secondary branches may be formed at that point. After the second summer but very little cutting is practiced except to thin out branches to prevent crowding in later years.

The method used in harvesting prunes for drying has influenced the type of pruning to a considerable extent. Except with Sugar prunes, little or no thinning of the fruit is practiced. The bulk of the crop is harvested by picking up the fruit from the ground where it falls at maturity. As a consequence, but little hand work is necessary with prune trees and no ladder work is required. The natural tendency has been to neglect pruning or to restrict it to periodical treatment when the cutting is apt to be entirely too severe. The fruit on prune trees is borne mostly on spurs, and the character of these vary somewhat with the variety. Under the system of pruning used, there is a tendency for the spurs to-

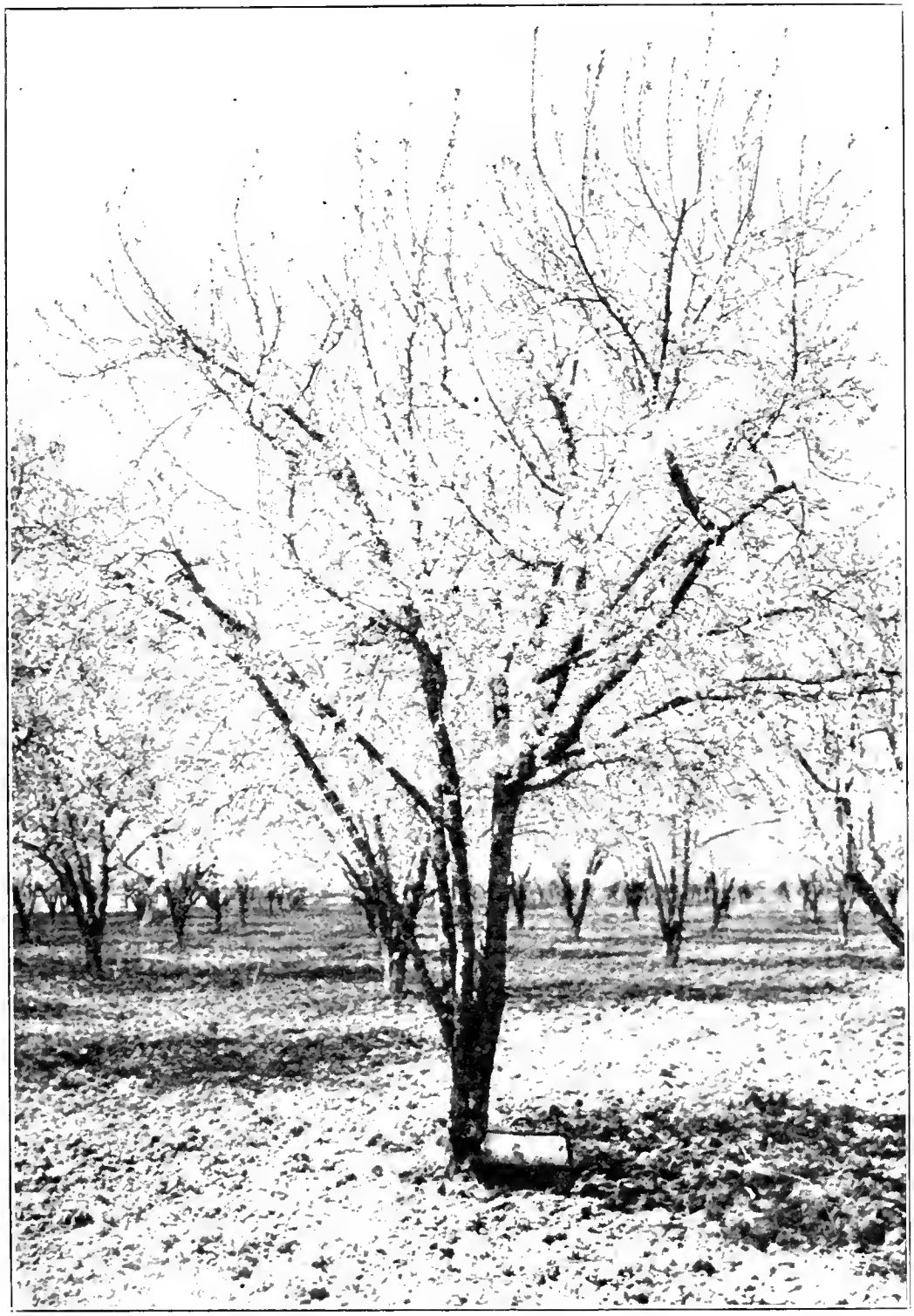


Fig. 4—A typical orchard of French prunes in full blossom.

ward the inner part of the tree to die out, leaving the bearing area as a comparatively thin umbrella shaped surface. Progressive growers are now adopting a system which calls for a light pruning given annually. This pruning consists in cutting out branches where too thick, removing old spurs no longer fruitful and opening up the tree enough to admit sunlight to the interior. This system, carefully followed out, has resulted in a steady increase in production. Sugar prune trees, as mentioned before, are usually cut back severely each year to reduce the amount of fruit set and lessen the loss from breakage.

Rejuvenation of Old Trees

The rejuvenation of old prunes is influenced by so many factors that no general rules can be given. In irrigated sections a drought of one or two years due to lack of winter rainfall in the higher altitudes, a break in the canal system or other causes will often so seriously set back a tree that but little can be done to bring it back into profitable bearing. Sunburn, followed by flat-headed and shot-hole borers, make short work of a drought-injured tree.

On the other hand, trees grown without irrigation may often be reinvigorated and made to produce larger crops when irrigation water is made available. One of the serious drawbacks to rejuvenation of old prune orchards is the susceptibility of these trees to injury by the various heart rot fungi. In practically every case where heavy pruning has been practiced for rejuvenation these organisms have gained entrance through the large wounds, in spite of protective covers as usually applied and the trees have shown evidence of internal rotting after a few years.

An interesting method of forcing young trees which have been stunted because of injury to the roots into a more rapid growth is by inarching young seedlings into the main trunk. Strong growing myrobalan seedlings are planted close to a tree and when approximately a quarter of an inch or larger in diameter are inarched into the trunk of the tree about twelve or fifteen inches from the ground. Usually two or three seedlings are used to each tree. The diameter of such trees so treated in one year's time is often double that of similar trees untreated, and the spread of branches is increased to a similar extent.

Diseases and Insects

Although the prune is grown with notable success on the Pacific slope, it is not without its insect pests and diseases. While it is true that it is not troubled with the curculio or the black knot so frequently found in eastern plum orchards, there are other insects and diseases fully as serious. It may be that the control of these troubles has been brought to a higher state of perfection here than elsewhere. Prune orchards are sprayed in a manner fully comparable with the practice in some of the highly developed apple sections of the eastern states. Furthermore, the equable climate, which tends to lengthen the life of the tree, also probably decreases the mortality of certain insects so that control is entirely dependent on preventive treatment rather than by natural causes. Among the scale insects found upon prunes may be mentioned the Italian pear

scale *(Epidiaspis piricola)*, brown apricot scale *(Lecanium corni)* and the San Jose scale *(Aspidiotus perniciosus)*, any one of which if left unchecked would seriously affect the crop and even the trees themselves. In addition, many districts are infested with peach borer *(Aegeria opalescens)*. The red spider and the various caterpillars feeding on the foliage are also very serious in some sections. In other districts the fruit is often scarred or entirely prevented from setting by the work of a minute sucking insect known as the pear thrip *(Euthrips pyri)*.

Diseases are also prevalent. In some cases they seem to take a more virulent form than found in eastern sections and, due to the compara-

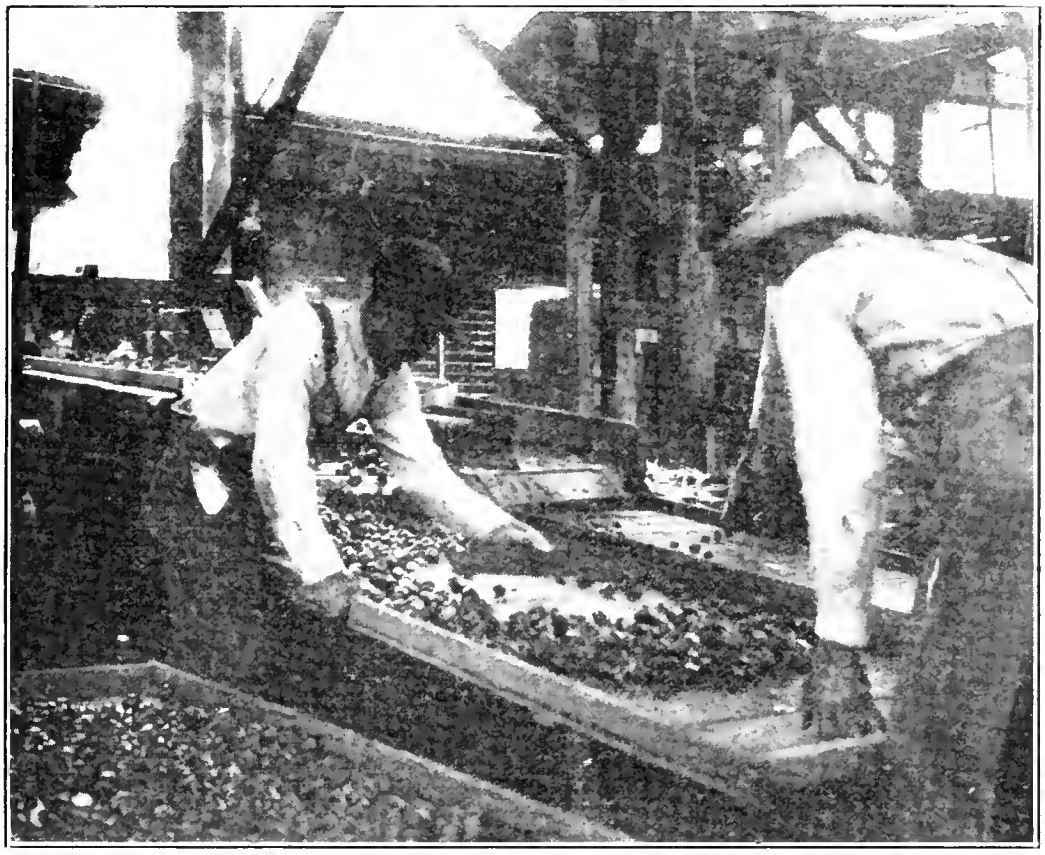


Fig. 5—After dipping, the prunes are graded into two sizes, spread on wooded trays and placed in the sun to dry.

tively high values of western orchard lands, seriously reduce the profits from many orchards. One of the most serious of these is brown rot *(Sclerotinia cinerea)*. This disease not only attacks the ripening fruit, but early in the season attacks and kills the fruiting spurs and twigs in many sections like western Washington and the central coast region of California. Heart rots are likewise prevalent in the same regions, and materially reduce the income from the orchard. Another fungus particularly difficult to control is one locally known under different names, such as oak fungus and mushroom root rot, caused by the toadstool fungus *(Armillaria mellea)*. This disease works on the roots of stone fruits with great rapidity. It spreads from root to root in an ever-increasing area until in some orchards an acre or more may be affected. No cure seems possible except a barrier of concrete or other material built around the

diseased area and placed deeply enough in the ground to prevent the healthy roots from coming into contact with diseased ones. The French pear and the California black walnut roots seem resistant and are being planted in the diseased areas to replace the prune trees which have died from the disease.

Spraying

In spraying the Pacific Coast states occupy a leading position. In spite of the progress made, the western fruit grower is not satisfied to sit back complacently, but is continually on the lookout for better spraying methods and materials. It is interesting to note the number of sprays first used or at least brought to perfection in the western states. Among these are the lime-sulphur solution, crude and miscible oil emulsions, neutral arsenate of lead, wettable sulphur and lastly the newest material, nico-dust. The use of all these new materials can mean but one thing and that in many cases the old remedies were not effective under his conditions. Are these new remedies necessary? Would not the old ones have answered the purpose? Upon analyzing them it can readily be shown that each new remedy is a necessity. Lime-sulphur, for example, first used for San Jose scale, proved to be only moderately effective against the brown apricot and Italian pear scales. One spraying of crude or miscible oil, on the other hand, so effectively reduces this pest that only one spraying of this material is necessary every two or three years. Neutral arsenate of lead is used for summer spraying against caterpillars in the coast region of California where the acid form seriously burns the foliage. Wettable sulphurs were produced to aid in control of red spider where the lime sulphur solution caused burning of the foliage. Nico-dust applied with a duster was found to effectively control the thrips where the old tobacco sprays were ineffective.

The western grower has also learned the value of making the applications at the correct time. The first appearance of such insects as aphis, canker worm, thrips and red spider is carefully observed in order that the spray may be applied before it is too late.

Harvesting and Curing

The harvesting of prunes for drying is a comparatively simple matter. The fruit is allowed to ripen on the trees and fall of its own weight. If picked sooner, experience has shown, it does not contain as much sugar as that which falls naturally and the shrinkage in the curing process is much greater. Picking the fruit from the ground is usually done on a piece-work basis by families or groups of workers who contract to do the picking at a stated price per ton.

The fruit is then dipped in a boiling solution of lye to remove the bloom and check the skin to facilitate drying. The man who does the dipping is usually experienced and knows how much lye to use to secure the best results without making the fruit ragged. After dipping, the fruit is roughly sized into two grades and spread on the trays. For sun drying the trays are simply placed in the sun until the fruit is dry enough to store. The length of time varies with the weather, but usually ten days or two weeks is sufficient. The fruit is then sorted to remove the "bloaters" or insufficiently dried prunes and placed in bins to sweat for several weeks before delivery at the packing house.

Due to the impetus given dehydration of fruits and vegetables during the war and a disastrous season in 1918 in California, the use of dehydrators for curing prunes has become important. Many growers now use dehydrators instead of relying on sun-drying, even in sections where the latter method is entirely practical and safe. The chief advantages are the speed with which the crop can be handled and the independence of unfavorable weather conditions during seasons when the fall rains begin early. The dry yard space, usually consisting of approximately one acre for twenty acres of orchard, is then utilized for planting more trees. On the other hand, dehydration is usually somewhat more expensive than sun-drying, because of the fuel required and the rather heavy investment in an efficient modern dehydrator. In spite of the cost, the fact that the entire crop is quickly and safely cured regardless of any inclement weather, is the consideration that is causing many growers to dehydrate their fruit rather than to rely on the older methods of sun-drying.

In the dehydration process the dipped prunes are placed on trays on cars which are run into the dehydrator. Forced air circulation is used in most of the dehydrators now being built. The length of time for drying varies from twelve to seventy-two hours, but in most cases it is complete in about twenty-four hours. The best results are secured when the temperatures are not allowed to go above 165° F.

Upon delivery at the packing house the crop is carefully graded according to the number of prunes to the pound. There is a 10-point difference between grades, e. g., prunes between 80 and 90 to the pound are placed in one grade; those between 70 and 80 are placed in another, and so on. The larger sizes are more valuable than the smaller ones. The price is usually based on the 80-90 size. For prunes smaller than this a lower price is paid, usually amounting to one-half cent per grade. For the larger sizes, a higher price is paid in the same proportion, except for the very large, fancy prunes, which command a considerable premium. There has always been a strong demand for medium sized prunes, or those usually classed as 40-50's and 50-60's. These sizes sell very readily on any market.

Before packing for sale the prunes are dipped for a few seconds in boiling water and while still hot are pressed into tight wooden boxes. This dipping serves to sterilize the fruit so it will keep and gives the prunes an attractive glossy appearance.

Cooperative Marketing

During recent years the industry of growing prunes on the Pacific coast has been on a remarkably stable foundation, largely due to two factors of fundamental importance. The first factor is that of regular and heavy production. Aside from insect pests and diseases which can successfully be controlled by spraying, there have been but few calamities, such as loss of the entire crop by frost, winter injury or excessive rainfall in the ripening season. The second and more important factor is that of cooperative marketing. The history of the Prune and Apricot Growers Association in California, the Oregon Growers Cooperative Association in Oregon and the Association of Growers in Clarke county,

Washington, represent a splendid achievement in cooperative marketing. When the crop was formerly marketed by independent packers the industry was on a highly speculative basis and the prices received by growers was often ruinously low. The majority of the prune crop, in some cases as high as 75 per cent of the acreage, is now being marketed by these organizations. In addition to perfecting selling agencies, these associations have been active in gathering information relative to size and condition of the crop in other countries, increases in acreage and all other data necessary in determining a fair and equitable sales price.

Before the war Germany and other northern European countries were heavy consumers of the small sized prunes, not much in demand in this

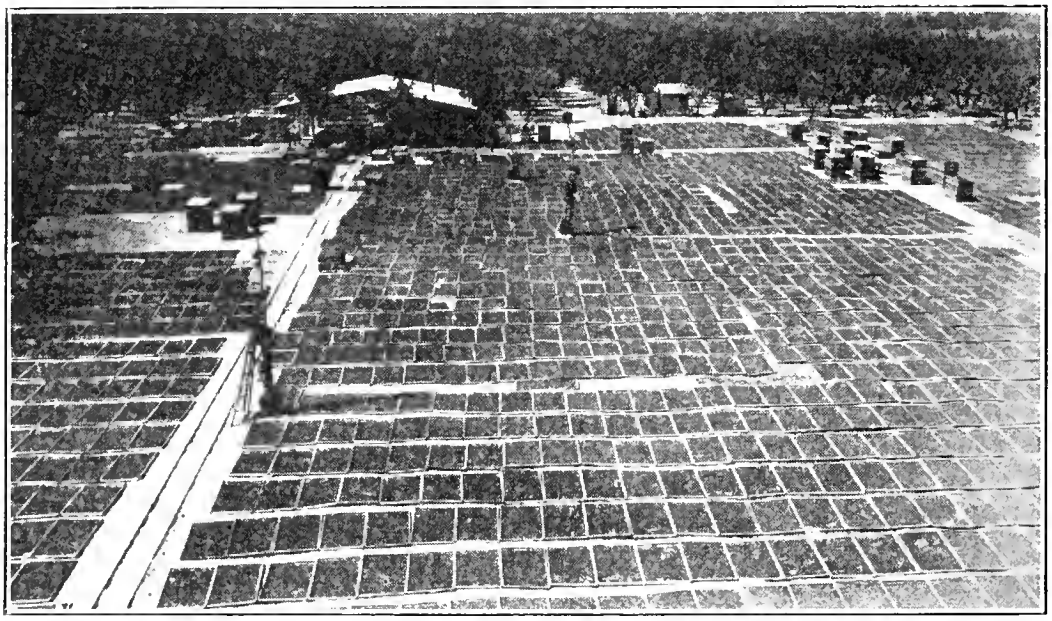


Fig. 6—Drying prunes in California. The fruit on the trays is left in the sun for about ten days. The trays are then stacked as shown in the background and the curing process completed in the shade.

country. With export for these sizes cut off an outlet was necessary for this portion of the crop. By-products factories were established and markets found for these new products. The number of uses to which small prunes can be put is truly remarkable. Among them are: Prune paste for use by bakers for making cake and pie filling; cooking syrup; and bases for extracts for use at soda fountains and in the manufacture of soda pop. From the kernels several kinds of oil are produced, and what is left is used for cattle feed. The shells are used for the manufacture of charcoal and for wood-flour, which is a composition largely used for the fancy work now found on many pieces of furniture.

Furthermore, large sums of money are being spent on advertising. The California Prune and Apricot Growers annual appropriation for this purpose is about $400,000, which is used largely in national magazines of wide circulation. Available statistics show that the annual consumption of prunes in the United States is approximately one and one-half pounds

per capita. If this consumption can be raised one-half pound per capita, it means an additional market for 50,000,000 pounds, or the yield from approximately 12,000 to 15,000 acres of prunes. The educational campaign carried on by these associations has been a decided influence in raising the lowly boarding house prune to the ranks of healthful fruit foods where it rightfully belongs.

Extent of Industry

Statistics secured from growers' associations and from the United States census give a fair idea of the extent of the industry. California, with 90,000 acres of bearing and 60,000 acres of non-bearing trees, is first in acreage. New plantings are coming into bearing at the rate of approximately 10,000 acres per year. Nearly all of the plantings are of the French variety and the entire crop is dried. Oregon has 23 564 acres bearing and 12,086 acres of non-bearing trees. Of this acreage it is estimated that all are Fellenburg, except about 1,200 acres of bearing and 500 acres of non-bearing, which are French prunes. The entire crop, with the exception of about 1,500 acres in eastern Oregon, is dried. Washington has a total of approximately 11,000 acres of bearing and 1,600 acres of non-bearing plum and prune trees. In the western part of the state the total planting is probably composed of 95 per cent Fellenburg and 5 per cent mixed varieties. In the north central and eastern sections the Fellenburg also predominates, with about 60 per cent of the planting, with the remaining 40 per cent made up of Tragedy, German, Sugar and several other varieties. In the western counties practically the entire crop is dried from year to year according to the fresh fruit market. Idaho has between 7,000 and 8,000 acres of prunes, practically all of the Italian (Fellenburg) variety. For the most part the crop is shipped east as fresh fruit.

The growing of prunes on the Pacific coast occupies a unique position in the horticulture of the United States, and for many reasons the stability of this industry seems to be assured. This fruit seems to be preeminently adapted to this particular section, both from the standpoint of long life of the orchard and regular production of the trees. At no time has there been serious competition from other countries. The product is one of excellent quality, and is available for consumption throughout the year. Furthermore, with proper means of distribution and improved methods of culture, the price can be kept low enough so that the great mass of people can always secure this palatable fruit at a reasonable cost.

THE FRUIT GROWING INDUSTRY OF INDIANA AND ILLINOIS

Prof. Laurenz Greene, Horticulturist, Lafayette, Indiana

Commercial fruit growing in the corn belt states of Illinois and Indiana is essentially of two kinds. First, those isolated plantings of small or moderate acreages whose owners sell the greater portion of their crops at the orchards or in nearby cities and towns. Such fruit does not figure in the car lot records and is difficult to accurately estimate as to quantity. Second, those large and small acreages in districts of larger production and smaller consumption whose owners must ship in car lots to the larger consuming centers.

The first group of growers is largely found in the central and northern sections of these states, while the car lot producers are largely confined to the southern counties, although car lot producers are found here and there in all parts of this district.

Soil types and the accompanying types of farming large determine the extent of the apple industry, while climate is an additional factor that defines the limits of commercial peach production.

In the black, more level lands of central Iowa, Illinois, Indiana and Ohio corn and live stock are the principal farm enterprises. Fruit growing on a large scale has never been developed in such communities, particularly if the soil type adapted to corn growing is extensive in area. The most probable explanation for the apparent incompatability of these types of farming and fruit growing is that these richer soils have attracted a class of citizen not interested in, nor possessing a knowledge of, fruit growing and its possibilities. In addition, fruit growing was usually first developed on the cheaper lands not adapted to grain crops. It should be noted, however, that later developments are often located on the very best and most highly productive soils, as is evidenced by the extensive plantings in Knox county, Indiana, near Vincennes.

Another factor which has, to a large extent, eliminated the orchard industry from our richer farming communities, even though it may have been more important a generation or two ago, has been the introduction of destructive insects and diseases. The orchard, a side line on these farms, in the latter part of the last century, fell a ready prey to these enemies because the owner was not dependent upon it for his livelihood. Other crops were easier to grow and the orchard was naturally allowed to decline through neglect.

This very condition has meant a stable and profitable business to the real fruit men in these communities by eliminating competing orchards. Today his market comes to him by auto and truck, saving him all the cost and worries of a car lot producer.

In Indiana and Illinois four principal kinds of fruits are produced in car lot quantities. Apples lead, followed by peaches, pears and small fruits, though the latter two are not important except in very restricted areas.

The Bureau of Agricultural Economics, at Washington, has supplied me with the following statement of the carlot movement of fruits from

these two states for the year 1922, including October shipments; the record for peaches ends October 23.

Car Lot Shipments of Fruits From Illinois and Indiana—1922

	Illinois	Indiana
Peaches	1,660	350 to Oct. 23
Apples	3,175	168 to Nov. 1
Strawberries	260	41 to Nov. 1
Pears	435	43 to Nov. 1

Apple production in Illinois is centralized in three general areas. The first is located in south central Illinois in Clay and surrounding counties. Clay county leads the state in apple acreage. Parts of nine counties surrounding Clay make up this first district. This district produces about 300,000 barrels.

The second district includes the well known Calhoun county, two counties, Adam and Pike, and a part of Hancock to the north and bordering on the Mississippi river and a portion of Green and Jasper counties to the east of Calhoun. This is the largest producing district of the state and is credited with 800,000 barrels. Much of this fruit is shipped to St. Louis by boat. It is interesting to note that Calhoun county, the principal county in this district, does not have a railroad within its borders.

Nearly 40% of the production in these two districts is Ben Davis. Scale and blister canker, however, are rapidly reducing this percentage.

The third district is located in the thirteen counties of extreme southern Illinois running from the Mississippi river to the Kentucky side of the state. This district is noted for its summer apples and is one of the principal summer apple producing centers of the United States. It is credited with 200,000 barrels. According to Professor Brock of the University of Illinois, 65% of this acreage is planted to early varieties and nearly 30% to Winesap.

Peaches in Illinois are also found in three distinct areas. The first two are within the borders of the first apple section of south central Indiana. The first peach section is found in Jackson, Jefferson, Washington and surrounding counties and this year produced 500 cars of peaches. While it is the smaller district, it produces the largest tonnage.

The second district lies to the eastward a few miles and centers about Olney and Flora, principally in Richmond and Jasper counties, and produced this year about 300 cars.

The third district is the early apple district, centering principally in Union and Johnson counties, and produced this year 300 cars.

Small fruits in car lot quantities are found in these same areas, centering in Pulaski, Union, Crawford and Fayette counties.

Apples are produced in car lot quantities in several counties of southern Indiana, the principal shipping counties being Lawrence, Orange, and Washington, known as the tri-county district, Knox, Brown, Morgan, Green and Putnam. Along the Ohio river in Harrison and Crawford, Perry and Warrick counties are found some car lot orchards. Much of this latter fruit moves by boat to Louisville and Evansville.

Peaches are centered in the tri-counties and in Knox, Gibson, and Van-

derburg counties. This western region is by far the most important and is well known for the quality of its product.

A small section of some importance, though not shipping many cars, is found on the shore of Lake Michigan, principally in LaPorte county.

Small fruits are shipped in car lots from the Borden district in Floyd and Clark counties on the Ohio river.

New commercial plantings of apples of these two states are not extensive in most regions, though a good, healthy growth in the industry is observed. Most plantings are being made by men who will take the best care of them. In a few centers larger plantings are being made, as, for instance, about Vincennes, in Indiana.

There is a peach planting boom on in these two states, limited largely by the small supply of peach trees. Professor Brock informs me that 30,000 trees are being planted in Pope county, where hardly a commercial orchard existed before.

According to the 1920 census figures, Illinois bearing fruit trees numbered 7,370,283, a reduction of 7,663,460 from the 1910 total of 15,033,743. Of this total apples show the greatest loss.

Bearing apple trees, 1910	9,900,627
Bearing apple trees, 1920	5,113,063

Total reduction in number of bearing apple trees, 4,787,564, or 49%.

Peach trees show a loss of 64%, leaving only 1,011,000 trees of bearing age. There were nearly 1,000,000 trees not yet in bearing in 1920 and large plantings since would probably show as many bearing trees in 1923 as in 1910.

Other fruits show some loss, but peaches and apples are the important fruits.

Indiana, according to census figures, lost 47% of her fruit trees between 1909 and 1919, the figures being 10,050,759 and 5,315,040, respectively. Apples showed a loss of 40%, or 2,337,005 bearing trees. The peach loss was about one and a quarter millions of trees, or 60%.

Other fruits of less importance made up the remainder of the five million trees lost.

Small fruits in the two states show about 1,000 acres increase, Illinois losing in acreage, while Indiana gained about 1,600 acres.

These census figures are of only incidental interest, as they have but little significance in relation to the commercial fruit industry. Larger losses occurred to farm orchards. The elimination of these trees naturally reduces competition slightly, but this factor, on the average, is more than offset by the increased production from the well cared for commercial orchards. Our total annual production in the United States is increasing, despite the loss of so many trees.

The commercial fruit growers of these two states are generally progressive and are using up-to-date and scientific methods in their orchard practices.

Mulching the orchard is perhaps more generally practiced in this region than in any other. This is considered a real advantage in the summer apple regions of southern Illinois, where the mulch serves as a

cushion upon which the early fruit may fall and prevent bruising as well as receive protection from the soil.

Cultivation and cover crops systems of soil management are found on the more level areas and a generous use of nitrate fertilizers is found in all sections.

A spray program sufficient to produce high grade fruit is generally followed, some of the best growers applying six or seven sprays annually.

The most serious insect is doubtless San Jose scale, which in the southern areas has proven more troublesome in recent years.

Apple blotch and blister canker are the two diseases of most concern to the growers, but recent developments have been more encouraging in the control of the former and more vigorous growth through better cultural methods is decreasing the menace of the latter.

Some new plantings are being made, but these in general are, as has been stated, the property of men who will give them the best of care. The individual units or plantings are tending to larger acreages than averaged a generation ago, but these plantings rarely reach the extreme found in many development schemes in the west.

The future for the fruit specialist in these two states is bright, whether he grows fruit for local or car lot markets. Cooperation as now being developed will take care of car lot shippers and the local market in most instances has not yet been adequately developed Good business judgment in fruit growing will mean success for the future fruit growers of Illinois and Indiana.

FRUIT GROWING IN WASHINGTON

M. L. Dean, Wenatchee, Washington

Fruit growing in the state of Washington dates back nearly one hundred years to the time when the traders of the Hudson Bay Company brought with them seeds and trees and planted them in different parts of the state.

About that time the Jesuit missionaries planted orchards in the coast territory in the Okanogan valley and at Kettle Falls on the Columbia river. These were all "Johnny Apple Seeds" of those days and started successful fruit growing in connection with their other activities. The famous old apple tree at the government barracks at Vancouver is the living monument of the Hudson Bay traders.

At Okanogan, in what is known as the Okanogan Smith Orchard, can be found Bellflower, Baldwin, King and Greening apple trees in a perfect condition of health, bearing heavy crops of fruit annually. Some of them reach a height of forty feet, having a stump diameter of nearly three feet with a tree spread of over fifty feet.

At Kettle Falls in the orchard at the Catholic school is to be found a collection of varieties almost identical with those found in the old orchards of the Atlantic coast.

In the coast territory or that part of the state lying west of the Cascade range of mountains, is to be found apple, pear, and plum trees which are as old as the traditions of the early traders and trappers' activities.

In these orchards can be found the oldest varieties known in the United States.

There are pear orchards in which can be found the same varieties as exist in the oldest pear orchards at Monroe, Michigan, which were brought direct from France by early French missionaries.

These tree seeds and scions were undoubtedly brought in by seafaring people who were looking for homes and landed on the islands of the Puget sound and the mainland of the northwestern part of the state.

The state is geographically divided into two distinct fruit sections, the coast region, that part west of the Cascade range of mountains, and the inland valleys.

The coast region has a very heavy annual rainfall and a uniform temperature during the whole year.

The inland valleys east of the Cascades vary in altitude from two hundred to twenty-five hundred feet, and have an annual precipitation of from four to ten inches each year, hence the necessity of irrigation for profitable production.

In these valleys is to be found a wide variation in their native horticulture.

In the Columbia and Snake river valleys are to be found climatic conditions almost sub-tropical, and are ideal for the growing of Vinifera grapes, while in other not far distant valleys only the most hardy varieties of fruit can be successfully grown.

Commercial fruit growing in the state of Washington is covered by the

past two decades; the present decade includes the orchards of the greatest development.

Many men can be found in each of the fruit sections who are classed as the "old-timers," yet they planted and brought to bearing the orchards they now own.

In 1895 John T. Blackburn, then president of the Washington State Board of Horticulture, said, "The cultivation of fruit in Washington is attracting increased attention from all parts of the civilized world today."

In the same year T. Smith of Colfax wrote, "The fruit industry of the state bids fair to become an important factor in its development and it may yet furnish the best prepared prunes for commerce as well as the best apples, pears, and cherries known in the markets."

Men are makers of history in fruit growing as well as in empire building. The whole history of fruit growing in the state of Washington is a record of the heroism of such men as Blackburn-Smith, D. M. Jesse of Walla Walla, Chat Knight of Vancouver, H. M. Gilbert of Yakima, W. T. Clark of Wenatchee, and many others whose names should be in the state horticultural gallery of fame.

The history is a record of obstacles, of prejudices broken down and successes won by scores of such men as those mentioned.

Orchards have lived and perhaps have now passed their zenith where the "oldtimer" said fruit could not be grown. The orchard regions of the coast country, the wind-swept sage brush lands of the prairies and valleys, all now pay tribute to the vim and courage of the pioneer Washington fruit grower.

The Coast Region

The coast region, that territory which is west of the Cascades, is characterized by its heavy rainfall and uniform climate. The results of this even temperature and excessive moisture are luxuriant growth of all vegetation, and with it exists ideal conditions for the growth of fungus organisms, such as apple scab, anthracnose and others. The predominating commercial fruits in the coast territory are the prune, the cherry, bush fruits, strawberries, and cranberries. Some varieties of apples and pears are successfully grown, though it is difficult to produce them free from scab. The principal prune grown is the Italian, although the French, the Hungarian, the Silver, and the Petite are grown in considerable quantities. Clark county, in the southwestern part of the state, produces more prunes than all other parts of the state combined.

The State Department of Agriculture Census of 1918 shows in this county a total of 665,990 prune trees. There were 225 driers in the county, having a daily capacity of 1,178 tons of dried prunes, and in 1919 this county put out 6,700 tons of the dried product. Walla Walla county ranks next in production and shipped 270 cars of fresh prunes in 1920. Yakima county takes third place and shipped 139 car loads in 1920. In Clark county is the only section where the crop is dried. In the other counties the crop is shipped as fresh fruit. The sweet cherry holds second place as a commercial tree fruit in the coast region. The Bing, Lambert, and Royal Ann are the principal varieties. The bulk of the Royal Anns are used by canning factories in canning and processing for "Mar-

aschino" cherries. The Blacks are shipped fresh to eastern markets. They have been placed upon the European markets in a number one condition, which shows the carrying quality of this fruit. During the past two years sour cherries, principally the Montmorency, have been extensively planted in several localities tributary to the principal canning factories. The varieties of apples and pears found in the coast territory are very similar to the Atlantic coast varieties, but with the moist climate, which is very conducive to fungus development, it is a difficult matter to sufficiently control apple and pear scab so that the fruit is marketable.

Small Fruits

The moist climate and the deep, rich soil make conditions very favorable for the growing of small fruits.

Vashon Island has been noted for its strawberry plantations for many years. Extensive plantings can be found in many sections along the entire coast country. A large part of the crop is consumed by the canning factories. In some sections the berries are refrigerated for confectionery uses.

Cranberry growing in the Ilwaco section, Pacific county, has become one of the prominent small fruit enterprises. There are about 100 acres of cultivated bogs in Pacific and Grays Harbor counties. The average output is from 35,000 to 40,000 boxes annually. Near Detroit in Mason county and at Bellevue, King county, grape growing is becoming a prominent industry; the Island Belle, a large purple grape, is the one variety which seems best adapted to this section.

The center of the small fruit industry is to be found in the Puyallup valley, Pearce county, in the vicinity of Puyallup and Sumner. Raspberries, blackberries and the loganberries are to be found here in extensive commercial quantities. This valley is undoubtedly the most famous valley in the world from the standpoint of intensive small fruit growing. The canning factories consume immense quantities of the fruit, but under the present refrigeration systems the berries are placed in the Twin City markets in prime condition and under special care are sent as far as Chicago and have been placed in the New York markets. In this county alone in 1920 there were 1,694 acres of red raspberries, about half Cuthbert and half Antwerp, 684 acres of blackberries, 796 acres of strawberries, 80 acres of loganberries, besides currants and gooseberries. The canning factories of this county consumed 12,866 tons of berries and about 200 car loads of fresh berries were shipped besides what were consumed in the local markets of Seattle, Tacoma and the other cities.

Small fruit growing is rapidly increasing in many other counties. This is also one of the important truck gardening sections. From two to five hundred car loads of head lettuce are shipped to Chicago and other eastern markets each winter, besides vast quantities of truck which is distributed to the cities of the entire Northwest.

Bulb Growing

The U. S. Department of Agriculture has bulb testing gardens in Whatcomb county, in which it has been demonstrated that lilies, gladioli, crocuses, tulips, hyacinths and the other bulbs can be grown in that territory equal to the Holland bulbs in many respects. This promises to be an important industry in that section.

Seed Growing

Many kinds of garden seed are grown in commercial quantities in Skagit and Snowhomish counties.

The bulk of the radish, cabbage and cauliflower seed of the United States is grown in this section as well as large quantities of onion and other seeds.

Nuts

The largest filbert growers in the Northwest are found in the vicinity of Vancouver. Figs are also grown successfully here. The English and Persian walnuts are to be found as scattering trees and in commercial groves the entire length of the coast territory, from Vancouver to Blaine. Almonds are successfully grown along the banks of the Columbia in Klickitat county. The chief horticultural industries of the coast territory are, in the order of their prominence, prune growing, small fruits, cherries, apples and pears, interspersed with truck gardening, garden seed, bulb growing and nut production.

The Inland Valleys

The commercial fruit growing in the interior part of the state is confined to the irrigated valleys of the Columbia, the Snake, the Yakima, the Wenatchee, the Spokane, the Okanogan rivers and their tributaries. The fruit producing districts as classified by the State Department of Agriculture are known as Yakima, Wenatchee, Okanogan, Spokane, Walla Walla.

The Yakima district includes the territory along the mountain benches in Kititas county, the various valleys in Yakima county, and Benton county, extending to the Columbia river.

The Wenatchee district includes the territory along the Columbia and Wenatchee rivers in Chelan and Douglas counties, and bordering the Columbia in Grant county, and also the Okanogan valley.

This territory and the Yakima district are the two principal fruit producing sections in the state. The main difference between them is that Wenatchee is more intensely planted to apple orchards, while Yakima is diversified with all tree fruits. These valleys have a normal altitude of about 900 feet, yet in both of them along the Columbia can be found conditions which are almost sub-tropical and many of the California grapes are grown with success. The Spokane district is located on a higher elevation which restricts its list of successful varieties somewhat. In this district is located the Kettle Falls section on the Columbia.

The Walla Walla district is a tributary to the Snake river territory and has a climate especially suited to the growing of prunes and other

soft fruits. This section ranks second in the state in the production of truck garden crops. Each district has some outstanding feature. The development of commercial fruit growing in this state has been phenomenal. Today it ranks third in the state from the standpoint of commercial value.

In 1919 the total value of all crops in the state was 161,000,000 of dollars, the value of the lumber cut was $100,000,000, and the value of the fruit crop amount paid the growers was $61,535,064, $53,740,811 being for fresh fruits and $7,794,253 for fruit products.

The growth of the industry can best be shown by comparisons. The state of New York always comes to our mind in making any fruit comparisons, although it is but a few years ago that Missouri had more apple trees than New York. The United States census of 1900 gave New York in round numbers 15,000,000 bearing apple trees, Missouri 20,000,000 and the state of Washington less than two and three-fourths millions. The 1910 census shows that New York dropped to eleven and one-fourth millions trees, producing 5,666,000 barrels, Missouri with 14,360,000 trees produced less than one-half as many apples, 2,533,000 barrels, while Washington, with her gain reaching three million, had an increase of 273,513 trees, which was a greater increase than was made by any state except Minnesota, which gained 504,000 during the ten years. In 1910 Washington produced from the three million trees 1,933,000 barrels and ranked sixteenth in importance as an apple producing state. Up to the year 1917 New York had always produced more apples for market than any other state. That year the New York crop was only 2,300,000 barrels of commercial apples and she ranked second to Washington, which produced 4,176,000 barrels for market, Missouri producing 1,155,000 barrels. This gave Washington over one-half million barrels more than the combined commercial crop of both New York and Missouri, jumping from sixteenth place in 1910 to first place in eight years.

This fact must be recognized as a wonderful showing for a state that has to ship its product from two to three thousand miles to the consuming market.

The commercial value of the boxed apple that year was $19,886,000, to which should be added the value of the canned and evaporated and other fruit products of nearly 5,000,000 of dollars. In 1918 New York forced Washington back to second place, but in 1919 Washington forged ahead again, distancing all former competitors with 16,146,000 boxes, or 5,382,000 barrels. This was 650,000 barrels, more than twice the New York crop of that year; it was more than the combined crops of New York, Missouri and Virginia, the three leading apple producing states in the East. It was 500,000 barrels in excess of the combined output of Idaho, Oregon, California, Colorado, Utah, Montana, New Mexico and Arizona, the other eight states west of the Rocky mountains which produce apples.

These figures show what has been done, and still apple production in the state has only begun. The possibilities are beyond comprehension.

As a peach producing state Washington takes third place, Georgia first, California second. In pear production California takes first place, Washington second. With the numerous reclamation projects completed

which are now proposed, and with many substantial progress is being made, it will bring under cultivation millions of acres of land, a large part of which is as good fruit land as any which is planted at the present time.

The Big Bend project, the Greater Wenatchee project, the Rim Rock of Yakima, the Horse Heaven of Benton county, the Pipe Stone of the Methow, and others are all being pushed as rapidly as conditions warrant. And when they are completed and water spread over them millions of acres now practically barren will blossom like a rose and will become productive orchards, gardens, alfalfa fields, and happy homes for a new population. When all of these vast areas are brought under successful cultivation and we look at the wonderful possibilities of the great future of this vast territory, of the fertile virgin soils, of the amazing horticultural and agricultural resources, our ever-increasing population, and prosperity, one fully concurs in the opinion of Gladstone when he said, "The American union has territory fitted to be the base of the largest continuous empire ever established by man." And the state of Washington has one stretch of this territory in her inland empire.

Soils

We should not pass without making some mention of the soil. It is largely volcanic ash with a mixture of pulverized basalt and disintegrated granite, a soil that when properly filled with humus is easy of cultivation, holds moisture and responds readily to the addition of natural or commercial fertilizers. Moisture is indispensable, and as the normal precipitation is so limited, ample water from the irrigation systems is a fundamental necessity.

The system of tillage in the most successful orchards is the "cover crop," alfalfa being the predominating crop. Where sufficient moisture is lacking other crops are substituted. The clean cultivated orchard is becoming very rare. As is true in all new orchard sections, the original plantings were not given sufficient space. Many trees were planted eighteen feet apart, more twenty, and the majority were only given about twenty-five foot space. Occasionally a man had sufficient foresight to give his trees thirty to thirty-two foot space. One of the greatest problems today with the Washington orchardist is to remove a portion of his trees to the best advantage so that they will have proper room. The trees are interlocking, fruit is becoming small and lacking color. It is impossible to spray properly for the best control of the pests, every operation demanding more space and nothing supporting the theory of such close planting. Younger plantings are being given thirty to thirty-two foot space and some are stretching that, using fillers of various kinds. Annual pruning is being done.

One of the operations which is showing wonderful results is systematic thinning of the fruit as soon as possible after the fruit is set. The best growers thin the pears to eight to twelve inches and all apples from six to twelve inches, depending upon variety and crop. Many growers pay more money for thinning the crop than it costs to pick the fruit, but they reduce the percentage of culls and grade, and increase the percentage of

extra fancy and fancy. Some crops run as high as 90% extra fancy from the orchard.

Pests

Codling moth, San Jose scale, Green, Rosy and Wooly aphis, together with Blister Mite, are the prevailing pests found in the Washington orchards. Pear blight and collar rot do a considerable annual damage, although the fungus troubles are negligible in the interior sections.

Spraying

The spraying campaign starts with the dormant application of the lime sulphur solution or oil emulsion for San Jose scale, blister mite, leaf roller and similar pests. The apple powdery mildew is the one fungus trouble demanding careful attention, some seasons. This is usually controlled by early applications of weak lime sulphur sprays, supplemented in extreme cases by the addition of the lime sulphur to the calyx spray. The codling moth is the one bugbear to the apple grower and this season she has seemed to rally all her forces to baffle the efforts of the growers, taking an estimated toll of $2,000,000 from the crop. Yet there are many growers in every section who with their systematic campaign of activities have prevented any appreciable commercial loss from wormy apples. To give an idea of the amount of spraying done in the state the following figures gathered show that in the year 1920 spray materials used in the state were as follows:

Pounds of dry sulphur	550,795
Pounds of dry arsenate of lead	2,195,591
Barrels of concentrated lime sulphur solution	25,416
Pounds of paste arsenate of lead	287,995
Dormant oil, barrels	840
Distillate emulsion, barrels	153
Pounds of Black Leaf Forty	20,691

Harvesting

Up-to-date methods of harvesting, handling, packing and storing are used in all sections of the state.

Selling

The crop is handled through various channels of trade. Cooperative organizations of various kinds handle large tonnages, dealers of all kinds each get their share and a few growers ship direct to the eastern trade.

Advertising

Washington growers and dealers believe in publicity. We feel that we produce a good product and are anxious to have the world know it. All sections advertise more or less, but the most extensive campaign is being carried on by the North Central Washington and Wenatchee Valley Growers in their "Eat Wenatchee apples" campaign. One million dollars will be spent in the next three years on a basis of three cents per box.

More than sixty per cent of the acreage of the district is signed under contract for three years to raise this fund. All dealers are supposed to deduct the three cents per box from fruit handled and turn it to that fund. They will spend about one million dollars in general publicity work and we hope that you, each of you, will catch the idea, "Eat Wenatchee apples." Washington probably stands second to California in publicity expenditures.

Varieties

After all, if the proper varieties are not planted under favorable conditions maximum results cannot be obtained. Many mistakes have been made in all fruit sections and the question of elimination is one that every grower is obliged to solve. To produce that variety which he can grow to the highest state of perfection at a minimum cost is a vital economic problem. In many of the older orchards can be found a conglomerate list of varieties, many of which are practically worthless for commercial purposes. A list of ten varieties will include the most profitable sorts for the state, and the most successful growers are reducing this list by one-half. In the state as a whole the varieties range as follows in the order of their popularity as shown by the 1918 orchard census by the State Department of Agriculture.

Winesap	1,904,932
Jonathan	1,343,720
Rome Beauty	777,582
Delicious	555,064
Spitzenberg (Esopus)	449,426
Stayman	271,279
Newtoun	220,391
Winter Banana	75,184
Arkansas Black	64,021
White Winter Pearmain	47,085
Miscellaneous	668,731
Making a total of	6,617,785 apple trees

In pears, there were 822,514 trees; peaches, 538,286; prunes and plums, 879,485; apricots, 57,111; cherries, 162,893.

The average yield of apples per tree for a period of six years, 1914 to 1920, in the Yakima valley, all ages of trees, was 3.31 boxes, which shows that the trees have not reached their zenith of production and there is a big chance for improvement.

In the season of 1919 and 1920 from October 1, 1919, to March 1, 1920, the average price per box received by the growers for all varieties in Wenatchee was for:

Extra Fancy	$2.816
Fancy	2.544
C Grade	2.153

Yakima:

Extra Fancy	$2.674
Fancy	2.405
C Grade	2.153

The average for all grades, all varieties, was $2.234 per box. These figures are compiled from the Reports of the U. S. Federal Bureau of Markets.

In conclusion, in the state of Washington can be found a fruit producing territory. It has the natural attributes, such as soil, moisture, climatic and atmospheric conditions, for the production of high grade fruit, but maximum results cannot be secured by the growers until all of them adopt and practice the best up-to-date methods and three things are provided—better transportation facilities, more up-to-date storage, and more paved roads.

COMMERCIAL APPLE GROWING IN THE ANNAPOLIS VALLEY, NOVIA SCOTIA

Prof. W. S. Blair, Experiment Station, Kentville, Nova Scotia

Nova Scotia is a peninsula on the extreme eastern side of Canada. It extends into the Atlantic in a northeasterly and southwesterly direction, and lies between the forty-third and forty-seventh parallels of north latitude. The total area of the province is about 21,500 square miles, the population is over 600,000. The surface is gently undulating, with no very high hills, and with no part of the interior over thirty miles from the sea. Because of the surrounding waters, the temperature is moderate, there being no great extremes of heat or cold.

The leading horticultural industry is fruit growing. Its most important division is apple culture. Pears, plums, cherries and small fruits are successfully grown, principally only in sufficient quantities to meet the demands of local markets. Apples, on the other hand, are shipped to Great Britain and other foreign markets, where they compete successfully with those grown in other provinces of Canada and in other countries.

The chief apple growing region of Nova Scotia is a small section of the northwesterly part of the province, generally known as the Annapolis valley, comprising one larger valley on the western and connected with six smaller valleys in the eastern end. This Annapolis valley is separated from the Bay of Fundy—that branch of the Atlantic that bounds the northwestern part of the province—by a range of hills, some four or five hundred feet in height, known as the North mountain, and consequently is protected from the direct force of the northerly and westerly winds. On the other side of the valley is a similar range of mountains of about the same height, known as the South mountain. The valley is about one hundred miles long and from six to eleven miles wide.

Practically all the exportable fruit of Nova Scotia is grown in the three valley counties, Kings, Hants and Annapolis, and of these, Kings county produces fully one-half of the total product. There are in Kings county approximately eighteen thousand acres of apple orchard. The five rivers draining this valley section are tidal streams for a considerable distance inland. Along these rivers are valuable dyked (hay) areas protected from the tide by dykes ranging from three to eight feet high. The difference between high and low tides at the mouth of these rivers is, in some cases, as much as thirty feet. The orchard lands are the rolling lands bordering these protected alluvial deposits, the higher elevations along the center of the valley, and the slopes of the North and South mountains.

The soil consists of sand, sandy loam, and clay loam overlaying largely a sandstone formation. The subsoil generally permits of ready drainage, this being particularly favorable for growing fruit trees. On the more sandy areas the soil lacks humus and such lands require ample fertilization in order to grow good trees and fruit. The sandy and clay loam soils are more fertile and naturally produce good crops with very moderate applications of fertilizer.

The climate of this valley country is, because of its situation, milder and more equable than that of other parts of the province. Extremes of heat and cold are not found. The mean average temperature for the summer months (June, July and August), is about 62 degrees, and the average mean temperature for the winter months (December, January and February), is about 22 degrees. The temperature during winter seldom goes below zero, and if it does, rarely remains there for more than a day at a time. The first frost occurs toward the last of September, the first severe frost about the 25th of October. The last frost occurs early in May. The summer temperature seldom goes above 90 degrees and averages 88 degrees as the highest. The rainfall during the summer ranges from two to three inches per month and is fairly evenly distributed. The total precipitation during the year averages thirty-eight inches. The snowfall, which approximates sixty inches, seldom is greater than six inches, one fall being largely dissipated by southerly winds before another takes place. Sleighing varies from three weeks to two months during the winter. The bright sunshine during the year averages 1,750 hours. Hail storms are practically unknown, and lightning and very heavy wind storms seldom occur.

The French Acadians, the first settlers, planted apple trees in their early settlements. In 1761, when the New England settlers came to occupy the lands of the deported French, they found apple trees in bearing, many of which lived and bore fruit for over a century. One tree, which was later grafted to Bishop Pippin (Bellflower), is still fruiting, has a circumference of 12 feet and is said to be 152 years of age. Another one, stated to be 125 years of age, grafted with Gravenstein, from which 28 barrels of packed fruit was harvested in one season, is still producing abundantly.

A number of new varieties were introduced from England by these New England settlers, among them the Nonpareil (Roxbury Russet) about 1765, the Yellow Bellflower (renamed in the valley Bishop Pippin) after its introducer, Dr. Inglis, the first bishop of Nova Scotia, in 1790, and the Ribston (Pippin) in 1814. Other varieties introduced early were the Baldwin and the Rhode Island Greening in 1820, the Blenheim in 1829, the Gravenstein and Alexander about 1835 and the Northern Spy about 1852.

For a number of years, however, the cultivation of apples was considered only as a side line to general farming, and it was not until about fifty years ago that the potential value of the industry was recognized. The exportation of apples to England began in 1875, and has increased steadily since that time. In 1896, the marketable crop, shipped chiefly to Great Britain, was half a million (500,000) barrels. In 1912 the number of apples packed and sold was over one million barrels. In 1919, 1,600,000 with a total value of nearly ten million dollars ($9,989,680); in 1921, over two million barrels (2,036,065) valued at nearly thirteen million five hundred thousand dollars ($13,478,750). About one-tenth of the total output is sold in the maritime provinces of Canada; the balance is shipped to Great Britain and other European countries, Newfoundland, the Canadian West, the West Indies and South Africa. The varieties of

apples grown have been selected chiefly with reference to the English market. Leading commercial sorts are: Gravenstein, Blenheim, Ribston, King, Bishop Pippin (Yellow Bellflower), Cox Orange, Wagener, Baldwin, Stark, Spy, Golden Russet, Fallawater, Nonpareil (Roxbury Russet) and Ben Davis. The Gravenstein, especially, reaches a very high quality in this district. The leading winter varieties grown in other parts of Canada and the United States also do well. Because of the cooler summer the Jonathan, Delicious, Stayman Winesap, York Imperial and Newtown Pippin do not reach the state of excellency of countries having a higher summer temperature. However, these varieties are all being grown to a considerable extent, but are often not as fully matured at harvest time as they should be.

Orchard management is not greatly different from that of other fruit growing sections. The rainfall is ample for all needs if proper cultivation methods are used. The practice followed almost exclusively is late fall or early spring shallow plowing, followed by frequent harrowing, using the disc or smoothing harrow every two weeks to keep the ground well worked. This harrowing is done up to the middle of June or not later than July 1st. Between these periods a cover crop is seeded, vetch or buckwheat being used principally. The growth from this seeding is plowed under, usually in the fall. Commercial fertilizers are depended upon almost entirely for enriching the soil. Nitrate of soda is used almost exclusively for nitrogen. Slag, or acid phosphate for phosphorus and muriate of potash for potash. One hundred and fifty to two hundred pounds of nitrate of soda, five hundred pounds of slag or acid phosphate and one hundred pounds of muriate of potash per acre is the usual application. This is applied in the early spring, generally towards the middle of May. Apple trees are in bloom between the 25th of May and June 7th. As a rule, the springs are cool and growth is not rapid until after June 1st. The harvesting of the fruit, except of some very early sorts, extends a little over one month, from September 5th to October 25th. After this latter date there is danger of loss from fruit. In order to get good color the fruit is left on the trees as late as possible. This makes a great amount of fruit gathering in a very short space of time.

Because of the maritime situation the air is moist and so favors fungus development. Of all our orchard diseases the apple spot or scab is the one most troublesome. It is pretty well established that two sprayings before bloom thoroughly applied, the first just when the leaves are hardly the size of a dime and again just before the blossoms open, and two or three sprayings after the bloom, one just after petals fall, and another one or two at intervals thereafter of ten days, will give good control. Bordeaux mixture with an excess of lime over the old formula (4 pounds copper sulphate, 8 pounds hydrated lime, and water to make 40 gallons), is being largely used. Lime sulphur is used somewhat, but not nearly so extensively as a few years ago. It is because of injury to fruit and foliage this is being discarded. The poison used principally is arsenate of lime, although some growers still stick to dry arsenate of lead as the best poison for liquid sprays. Sulphur arsenic dust (90 parts superfine sulphur to ten parts dry arsenate of lead), and copper arsenic

dust (10 parts dehydrated copper sulphate, 5 parts calcium arsenate, and 85 parts hydrated lime), are being used almost exclusively by many growers. The heavy dews at night favor the use of dust, and for this reason its general use is likely to prove more satisfactory than it is in countries less favored in this particular. The dust is applied by power dusters in the early morning when the air is calm, commencing about or before daylight. The advantage of using dust is that very large areas can be treated in a very short time. It takes about five hours to spray an acre of mature orchard thoroughly, and a thorough job can be done with a dusting outfit in an hour. Very many growers do an acre in much less time. The cost of material is much greater when dusting, but this is offset by lessened labor cost. Approximately two pounds of dust will do a thorough job on a mature tree, as compared with six gallons of spray for the same tree. The fact that larger blocks can be protected by dust than would be possible if only spraying were done, is the principal reason why dusting has made such rapid development in Nova Scotia. It is usually necessary to make five applications, and some make six, during the season. Where the work has been thoroughly done the fruit is as clean as it is where sprayed. Power dusting outfits are now largely taking the place of the power spraying machines so generally used in the past.

A system of frost-proof warehouses has come into existence during the past twenty-five years, which are of great help in storing and packing the crop. At the present time there are over 120 of these warehouses. They are of sufficient size, about 40 by 100 feet on the average, to afford room for the packing and storing of from five to ten thousand barrels. Formerly the fruit grower packed his fruit at home and when a steamer was ready to load at Halifax, hauled his apples to the station, and loaded them into the waiting cars. Now, the apples are generally taken in barrels directly from the orchard to the warehouse, where they are stored until ready to be packed out for shipment. Under this system it is possible with very little delay to pack and place on the cars a steamer load of apples. A railway haul of four or five hours brings the cars to the side of the steamer, so that danger of frost, even in zero weather, is largely avoided.

A further advance was made in the business of packing and marketing apples when cooperative fruit companies were formed between 1907 and 1912. In the latter year, these companies, between thirty and forty in number, were amalgamated into the United Fruit Companies of Nova Scotia, Limited. This association controls over one-half of the apple crop of the province. A uniform standard of grading is maintained, an official of the central association inspecting the packing in all the warehouses of the affiliated companies, in addition to the inspectors provided by the Federal Fruit Branch.

Cooperation in the marketing of apples was quickly followed by the cooperative manufacture of barrels and the purchase of fertilizer, feed

and seeds. This aspect of the business is of no inconsiderable value, the annual amount of fertilizers handled by the association in 1922 being:

1,500 tons of nitrate of soda;
1,500 tons of acid phosphate.
2,000 tons of basic slag;
1,500 tons of mixed fertilizers.

A cargo of 2,200 tons of nitrate of soda landed at Windsor was practically all used in the apple growing section of Nova Scotia. Spraying and dusting materials handled by the United Fruit Companies in 1922 were:

Dry arsenate of lead	30 tons
Dry arsenate of lead paste	5 "
Arsenate of lime	50 "
Powdered bluestone	50 "
Dehydrated copper sulphate	30 "
Hydrated lime	800 "
Superfine dusting sulphur	45 "
Soluble sulphur	1 ton

The establishment of evaporators, canneries and vinegar factories throughout the fruit district, some of them owned by the cooperative companies, furnishes a good market for defective fruit. The barrel package is almost exclusively used for exporting apples in. The barrels are manufactured from native spruce and cost approximately fifty cents delivered at the orchard. Box packing has been followed to some extent, but net returns so far have generally favored the barrel package.

In 1911 an experimental station was established at Kentville by the federal government at Ottawa, one of its objects being to aid the apple growers of the valley in developing the industry to its fullest possibilities. The Entomological Division of the Federal Department of Agriculture have a staff of investigators conducting research work at different points, their headquarters being at Annapolis Royal.

Considering the climatic conditions, the situation of the valley near extensive forests of soft wood, suitable for barrels and boxes, and the facilities for reaching the large European markets, we feel safe in saying that apples can be produced in Nova Scotia and placed on those markets with as great a prospect of profitable returns as from any country.

APPLE BREEDING FOR THE UPPER MISSISSIPPI VALLEY

H. L. Lantz, Ames, Iowa

There is a vast rich agricultural region which for our purpose may be called the upper Mississippi valley or the Great Plains region of the Middle West. Roughly, this region is bounded on the south by the Platte river down to where it flows into the Missouri a few miles below Omaha, and by a line running eastward to the eastern boundary of Iowa, and thence up to the most southern point of Lake Michigan. The region north of this line is characterized by climatic conditions which have made fruit growing in most of this section comparatively difficult. None of the standard varieties of fruits have proven hardy enough to be reliably long-lived and productive under the climatic conditions which prevail throughout most of this great area. There is a great demand throughout this region for hardy red winter apples of good quality which are vigorous and productive, and which will come into bearing earlier than do most of the standard sorts now grown.

Bringing the question down to Iowa, we find that horticulturally the state is naturally divided into the north and south halves by a line which extends across the state a few miles north of Des Moines and which turns upward slightly at the east and west boundaries as the Missouri and Mississippi rivers are approached. The southern half of the state lies in the northern extreme of the Ben Davis belt. Such varieties as Jonathan, Grimes Golden, Ben Davis, Rome Beauty, Winesap, Delicious and other standard winter sorts, can be grown more or less successfully in this portion of the state. However, test winters periodically exact a heavy toll, killing outright many trees and severely injuring many others, so that it is very difficult to find anything like a perfect stand of trees in any of the orchards of this region. In addition to this, the climate is such that most of these varieties do not come into profitable bearing until they are 12 to 15 years of age. Clearly, then, there is a distinct need for new varieties in southern Iowa of the general character of Jonathan, but with trees which come into bearing earlier and which will be hardy enough to withstand the test winters which have in the past been so disastrous.

The northern half of Iowa is characterized by winter conditions which are much more severe than are found in southern Iowa; only the very hardiest varieties are reliably productive and at all satisfactory. This part of the state is in the southern part of the Wealthy belt and the varieties which succeed in this region are practically all summer and fall sorts, such as Yellow Transparent, Duchess of Oldenburg, Wealthy and some of the Patten originations, such as Patten Greening, Eastman and Brilliant. A few varieties, such as Malinda, Northwestern Greening and a number of the Russian varieties, are hardy, but are lacking in general quality. The whole northern half of the state is horticulturally characterized by a lack of good red winter apples.

These conditions present, then, great opportunity for the develop-

ment of new varieties of standard market quality, which will be adapted particularly to the northern part of the state and, in fact, to all parts of Iowa, and for all of the upper Mississippi valley and the Great Plains region.

The pioneer history of Iowa contains many interesting accounts of the agriculture of this state which chronicles the repeated planting and failure of practically all of the old standard eastern and European varieties and kinds of fruits. These pioneer horticulturists soon came to recognize the limitations which were imposed by the climatic conditions of this region. Even as early as 1850 to 1860 we have some accounts of horticulturists who planted apple seed quite extensively with the idea of developing new varieties. This idea of originating new apples was consistently and urgently recommended, notably by Professor J. L. Budd of this institution and by C. G. Patten of Charles City, and others.

Apple breeding at the Iowa station was initiated by Budd in the 70's. He planted a great many seeds of selected hardy fruits. Of much of this material he knew only the seed parent. His later breeding work included actual crossing of many varieties. During the 80's he made several trips to Russia and imported many varieties and kinds of fruits which were distributed quite widely for testing. Most of these, however, have failed to make a place for themselves as commercial varieties. These Russian apples, however, have been a valuable contribution to American horticulture and some of them have proved to be worthy of serious attention for breeding purposes because they are so hardy and productive. The Russian apples which we have used at the Iowa station include Anisim, which is a very hardy and very productive red, sprightly sub-acid apple of medium size and fair quality of August season; Longfield, small, clear, yellow, good, tender, white-fleshed apple of August season, very productive and hardy; Oldenburg, very hardy, productive—one of the most generally known of the Russian varieties; Antonovka, a clear-skinned, yellow, hardy, productive, sprightly sub-acid, August apple; Hibernal, rated as among one of the very hardiest large fruited types, productive, an excellent tree with large, medium red, sprightly sub-acid fruit of poor quality.

In 1905, the late Professor S. A. Beach came to Iowa State College to head up the horticultural work of the institution. The problem of breeding apples for the upper Mississippi valley at Ames was one of those problems which appealed strongly to Professor Beach and induced him to take up the work in Iowa. In 1906 and 1907, a great deal of crossing work was done and out of this work came upwards of 5,000 cross-bred seedlings of known parentage. Many of these have been fruiting for the past four or five years. This lot of seedlings came from 43 mother parents which were used in combination with 50 pollen parents in 120 combinations.

The apple breeding project, as outlined by Professor Beach, had for its purpose, first, to determine what are the characters in the apple and how are they transmitted; second, to learn which parents and combination of parents would produce desirable progeny. Incidentally, the production of hardy, red winter apples has been and is an important

feature of this work. Wherever possible, the hardiest varieties grown in Iowa were combined with red varieties of good quality and late season. In this connection it is of interest to note that a great many of the resulting seedlings have been red winter apples of good quality, some of which appear to be hardy, productive and are of considerable promise.

In this paper no attempt will be made to critically analyze the progeny of the various parents and combinations of parents. We beg to present certain features of the work and to make mention of the performance of some of the parent varieties which have been used. Something like 2,000 seedlings have fruited and detailed descriptions have been made of the fruit and comparisons made with the parents as to the various characters and characteristics. Notes on the trees as to vigor, health, hardiness and productivity have also been made in the field. This lot of seedling material has now reached sufficient age to indicate pretty clearly that certain parents and parent combinations are of little or no value in breeding hardy red winter apples of good quality. Out of the 120 combinations of parents 62 appear to fall in this category, 43 are placed in the doubtful list. In this doubtful list, however, are many combinations of which too few seedlings were grown to secure sufficient information from which to draw accurate conclusions. Fifteen of the 120 combinations have given us progeny of merit. Certain of the most promising seedlings have been crossed back to the parents and with each other in order to secure inbred second generation material from which we hope to secure further information in regard to what are unit characters in the apple and how these are transmitted.

Methods of Studying Apple Breeding Material

Apple breeding along scientific lines is a comparatively new field in horticultural investigation. One of the first problems of the fruit breeder is to learn how to breed apples and propagate them, and then to learn how to observe and record results of his work. In our own work, which covers 16 years in the practical phases of apple breeding, many angles to the problem have become manifest. In fact, so many phases present themselves that it is often very difficult to determine what factors are of the most importance. With an extensive fruit breeding project involving thousands of trees and with a personnel inadequate to meet the demands of the work, it has been necessary to limit our attention to only those phases of the problem which appear to be of greatest significance. We have, therefore, focussed most of our attention upon the various seedling lots to determine, if possible, which parents and combination of parents transmit to their progeny desirable characters in nursery and orchard, together with desirable fruit characters. Practically the entire list of apples which we have used as parents were chance seedlings which can be properly termed "mongrels." It at once becomes apparent that the laws of inheritance of characters as applied to apple breeding are exceedingly difficult to interpret.

Those who hybridize grains or flies, as the case may be, which represent pure lines, can readily discover the fundamental laws of heredity. The breeding of apples presents a vastly different problem. Varieties of

mongrel parentage are used for breeding purposes, the seeds are planted, trees of known parentage are grown, and at the end of 10 or 15 years there is available material from which may be determined some facts concerning the vigor, health, productivity and hardiness of the trees, and something about characters of fruits which are borne. The fruit breeder is able to grow perhaps 10, or perhaps it is a thousand, seedlings from a single combination of parents. No two of these seedlings are alike in this first generation. He finds a very great diversity in the distribution of characters and in the amount of variation in both the tree and fruit. By producing second generation material the fruit breeder may be better able to determine where he is at. The difficulty at this point is that it is almost impossible to self-breed the apple. We are attempting to overcome this difficulty by inbreeding the progeny of the same parentage.

Our apple breeding work has been carried far enough to indicate the value of certain parents in transmitting hardy, vigorous, healthy, seedlings which produce fruit of good size, good color and good quality, and late season. However, quality and hardiness do not seem to be correlated very closely with the production of red late keeping apples of good quality.

In our apple breeding studies the following lines of investigation have appeared most profitable:

I. *Propagation.*
   1. Germination of seed of various parent combinations.
   2. Vigor of seedlings of various parent combinations.
   3. Health of seedlings of various parent combinations.
   4. Habit in nursery of various parent combinations.
   5. Foliage in nursery of various parent combinations.
   6. Hardiness in nursery of various parent combinations.

II. *Seedlings in the Orchard.*
   1. Vigor, health and habit as an orchard tree.
   2. Hardiness in tree and fruit bud.
   3. Fruiting habit.
      (a) Age.
      (b) Productivity and regularity of bearing.
      (c) Bearing habit as compared with parents.
      (d) Persistance of fruit in hanging until mature.
      (e) Length of season required to mature fruit.

III. *Character of Seedling Fruit.*

1. Physical characteristics.
   (a) Size.
   (b) Color and attractiveness.
   (c) Form.
   (d) Ability to withstand injury in handling.
2. Flesh.
   (a) Color.
   (b) Texture.
   (c) Flavor.
   (d) Quality.
3. Season.

As we have studied the cross-bred seedlings particularly since they are of fruiting age, it becomes quite apparent that accurate judgments in regard to nearly every character, such as vigor, health, hardiness, productivity of trees, etc., must be formed slowly and only *then* when the opportunity to observe and study the trees has extended over three or four years after the trees have reached bearing age. This is especially important when hardiness, habit of bearing, health and vigor of the tree are being studied. We have found, for instance, that young trees which are vigorous and apparently hardy, often prove to be tender and "go out" the winter following a heavy crop.

Seasonal conditions induce a great deal of variation year by year in vigor, fruiting habit, productiveness and also in size, color and quality of the fruit.

The extent of these seasonal variations cannot be measured. The amount of rainfall and numerous other seasonal factors have a direct influence upon the vigor, health, and productiveness of the tree, and have even a greater influence upon the size, color, quality and season of the fruit. Conclusions, therefore, which are based on a single year's observation are not likely to be sound. We have endeavored to be conservative and have gone slowly, feeling that each year would give us additional information.

We feel like emphasizing the point very strongly that one of the fruit breeder's biggest problems is to learn how to study his material. This comes by years of experience, together with a wide acquaintance with named varieties so that proper comparisons may be made in order to study to advantage the various factors involved.

If rapid progress in the development of worthy new apples is to be made, it is desirable to learn as quickly as possible where to go among the many varieties to secure parents which transmit desirable characters of tree and of fruit. Our own work indicates that the characters which are manifest in many of our standard varieties as to vigor, hardiness, color, size and quality, is no indication that such characters are at all freely transmitted when these varieties are used for breeding purposes.

Some obscure varieties have given us very satisfactory progeny, while some of the leading standard varieties of high quality have been disappointing when used as parents.

Following is a list of those parents which, according to our work, appear to be of little or no value in breeding hardy winter apples for Iowa:

Ben Davis, Black Annette, Roman Stem, Walbridge, Scott, Utter, Patten Greening, Grimes, Oldenburg, Mountain Beet, Gano, and Ralls.

It is not desirable at this time to go into a critical discussion of the seedlings of the above parent varieties. Suffice it to say that lack of quality is predominant in the progeny of these parents. Furthermore, it appears that these parents in those combinations which we have developed do not transmit consistently in combination any of those desirable characters which are deemed vital in the breeding of new apples. To this list might be added a number of other varieties, but this shall not be done until our present information is considerably amplified.

Some of the parent combinations which have given us desirable progeny are as follows:

Allen Choice x Perry Russet: The trees are of good habit, vigorous; fruit firm, of good quality, often with good, solid red color and very late season. One of these seedlings has been named the Ames.

Colorado Orange x Allen Choice: The progeny of this combination is often vigorous and very productive; a high percentage of the seedlings are of firm flesh, late keeping apples of good quality. The yellow color of Colorado Orange predominates.

Colorado Orange x Jonathan: Trees rather variable in vigor, often productive. Fruit varies from yellow to red and the flesh varies from tender to rather tough; usually of good quality.

Hibernal x Delicious: Trees hardy, fruit often resembles Delicious in many respects.

McIntosh x Longfield: Trees quite uniform, hardy, vigorous, productive; fruit variable in size, color and quality. White flesh predominates throughout the series. Several very promising seedlings have developed in this line of breeding, two of which have been named Maud and Sharon.

Northwestern Greening x Harrington: Trees vigorous and productive; fruit firm, crisp and of late season.

Northwestern Greening x Wealthy: Trees very vigorous, productive, excellent foliage; fruit large, intermediate in color; season varies from that of Wealthy to mid-winter. A very interesting line of breeding. One of these has been named Macy.

Salome x Baltimore: Trees very productive; fruit rather tough, pretty good quality and of late season.

Salome x Delavan: Some trees of this line are very hardy. The fruit is variable in size, several are of large size and of late season and good quality.

Salome x Jonathan: Trees variable in vigor from weak to moderately strong. The Jonathan tree habit seems to predominate. Trees are productive; the fruit runs from small to large size. Color ranges from that of Salome to Jonathan are exhibited. About 25 per cent are sweet; all are yellow fleshed and many are of good to very good quality. This line of breeding represents perhaps one of the most interesting lines on account of the high percentage of apples of good quality and late season. However, on account of the tendency toward poor habit of growth which

is often exhibited, this line of breeding is being used judiciously in combination with other lines in order to combine vigor, hardiness, quality, and late season.

Wealthy x Allen Choice: Trees healthy and productive with considerable variation as to size and season.

Wealthy x Baltimore: Trees healthy and productive; fruit often very late in season.

Wealthy x Colorado Orange: Trees healthy and productive.

Wolf River x Harrington: Trees healthy, vigorous and productive; fruit red, occasionally with strongly perfumed flavors. Season ranges from that of Wolf River to late winter. Two of these have been named Monona and Afton.

The progeny of some of the other parent varieties have exhibited valuable characters. These desirable characters, however, are often not correlated with other valuable characters. From the standpoint of vigor, health and productiveness, Malinda in combination with Anisim and with Brilliant has given us uniformly a strong, vigorous and productive lot of seedlings which appear to be very healthy and hardy. These seedlings have produced fruit which is generally lacking in good quality. Many seedlings of this parentage are coarse grained, rather tough, and decidedly insipid and lack character in every respect. A few rank fairly good in quality.

However, such valuable considerations as that of vigor and hardiness of the tree cannot be overlooked. Even though the fruit lacks many desirable characters, it is believed that a line of breeding of this type is valuable as foundation material, because vigor and hardiness appear to be dominant characters.

Extensive apple breeding work at this station for the past six years has been done in the light of previous experience. Many thousands of seedlings are now standing in the orchard, nursery row and seed beds which range from one to five years of age from the seed. Among these are seedlings of second generation breeding and also large numbers of outcrosses between hardy parentage and parentage of high standard quality.

Summary

Scientific apple breeding is a comparatively new line of horticultural endeavor.

The vast region of the upper Mississippi valley is devoid of hardy red winter apples. It is believed that these can be originated by scientific apple breeding.

Apple breeding by the pioneer horticulturists consisted largely in selecting and planting seeds open to cross-pollination. Comparatively few of these seedlings have made a place for themselves on the planters' list.

In developing new apples of standard quality, it is desirable to have fundamental information as to what parents and parent combinations can be relied upon to transmit in combination those characters which must be brought together in order to produce new apples of value for this region.

Characters in the apple are apparently quite diverse. Therefore, in order to secure the right combinations it is necessary to produce many thousands of seedlings from which to select.

The characters of hardiness, high quality and late season are apparently very hard to bring together. In other words, hardiness of tree, good quality and *early season* are apparently closely correlated.

APPLE BREEDING FOR THE MISSISSIPPI VALLEY

Dr. C. S. Crandall, Urbana, Illinois

I am to tell you something of the plant breeding work that is in progress at the University of Illinois. We are just finishing up the fifteenth year since the present line of breeding work was started. Our line of work is somewhat different from the line of work that is carried on in Iowa and, as far as I know, at any other station.

The main object is to study the manner of transmission of the characters of apples and in order to do this I have wanted to use, in crossing, apples having as diverse characters as could be obtained. In the winter of 1907-1908, after correspondence with Dr. Sargent, of the Arnold Arboretum, at which place they have the largest collection of forms of Malus in the country, he sent me scions of fifty-seven different forms of the genus; these came under thirty-two specific names, and the others under variety names. Now, I am not prepared to say that I know anything about what should be a species and what should not, but that most of these forms that were sent were of hybrid origin I am quite well convinced. The evidence upon which I would base that statement is that in growing seedlings from these crab-like forms we get extreme variation.

Just to cite an illustration: We have one form of *Malus prunifolia*, which is one of the European species, and in growing something over one hundred seedlings from this form we have plants producing fruits that are no larger than marrowfat peas and some producing fruits that are two inches in diameter. They are yellow, green, and red, and they vary greatly in all of the characters that belong to apples. So that with all of our breeding material we are working with things that we know nothing about; that is, we know nothing about the ancestry. There is not one of our standard varieties that we know anything about, so far as its parentage is concerned. Of coarse there are certain varieties that are seedlings of definite varieties, but in these cases we do not know the male parent.

We began our work on an area of about two acres. This area has been gradually enlarged until at the present time the plantings occupy one hundred and sixty acres, and I am worrying the head of the department much of the time calling for more land. What we are going to do this coming spring, I do not know.

There are two or three different branches to the work, the main branch being the production of hybrids; that is, hybridizing between standard orchard varieties and these crab forms of which I have spoken, and occasionally between the crab forms themselves. Another branch is this: Is there anything in growing seedlings from fruits from selected trees? We went into the southern part of the state and in certain orchards there selected trees that were productive and that had a reputation for good qualities. We took the whole crop of fruit to the university, and at that time introduced a variation in procedure about the utility of which I do not know. I divided the fruits into two groups, on the basis of size; a group of small fruits, and a group of large fruits. Seeds of the two groups were saved separately and each group planted by itself. The

seedlings were grown for two years in nursery and then there were planted in orchard approximately four thousand seedlings. These represented seven varieties, as follows: Grimes, Jonathan, Winesap, Ben Davis, Rhenish May, Minkler, and Arkansas Black. There was not an equal division as to the number of seedlings from each variety. These trees are now fourteen and fifteen years old and they have commenced fruiting. Up to the present time we have fruited 27.55 per cent of the seedlings that are living at this time. Of course we have lost some trees in almost every year and the percentage of trees fruiting is based upon the number now living, not upon the original number planted.

As the trees fruited descriptions of the fruit were taken and those that apparently had good qualities were marked up to be preserved. Those plainly of no value are marked for removal. There is one interesting thing here as to the number of promising seedlings that have appeared in the various lots; for example, there are one hundred and sixty-three seedlings of Arkansas Black; twenty-two of these have fruited and twelve of them are marked to be preserved. Of Ben Davis there are 2,370 seedlings and thus far fifteen are marked for propagation and preservation. As to the other varieties, eleven seedlings of Smith Cider are to be preserved, seven of Winesap, two of Minkler, three of Rhenish May, one Jonathan, and two of Grimes. We are propagating from all of these selections and when the trees fruit it is altogether possible that many of them will be disappointing, but we hope that some may be of sufficient excellence to warrant naming and introducing.

There are a number of things that we do not yet know about these fruits. We have not accurate information as to season, nor do we know the keeping quality, and there is a possibility that judgment regarding flavor may be reversed. But from the fact that we have only a little less than twenty-eight per cent thus far described, there are many yet to come. But our chief interest has been in hybrid seedlings. We have tried to make as many combinations of parents as possible and so far have attempted between fourteen and fifteen hundred combinations. Of course many of the combinations attempted failed and some that were apparently successful did not produce seedlings with sufficient vitality to live. However, at the present time we have a little more than 21,000 hybrid seedlings living, and of these, 3,755 are of the second generation. Where crosses have been made between a large fruited parent and a small parent, just as soon as the seedling comes into fruit our practice is to polliuate back with the large fruited parent. Whether this is the right policy or not I do not know. We will find that out later.

These second generation seedlings are the ones in which interest chiefly centers. The first generation seedlings represent somewhere between six and seven hundred different combinations of parents. We have had some disappointments in our work; for example, we had some hopes that some of our natives might prove good as breeders. There are the Soulard crab, the Mercer County crab, the M. Coronaria, the crab of the east; the M. Ioensis, the crab of the west; the Angustifolia, the crab of the south, and M. fusca, the Oregon crab. We have done a little work with most of these crabs and have been greatly disappointed.

I have some figures on the crossing that we have done with some of them; taking, first, the Soulard. This crab produced an extremely healthy tree. It is vigorous, strong, does not seem to be troubled by any disease and the fruit is of fairly good size. Now, if we could put some quality in the fruit and reduce the acidity, we might get something that might be of some value. But this is what we have done with the Soulard: About thirty crosses were attempted and only eight of them produced fruits, so that most of the pollinations were not successful. However, we have 19 seedlings, 4 and 5 years old, but they are so weak it is doubtful if any live to fruiting.

THE INVESTIGATIONAL WORK WITH PEARS AT THE GEORGIA EXPERIMENTAL STATION

H. P. Stuckey, Director Georgia Experiment Station, Experiment, Georgia

Pear culture in the South received a great impetus following the early seventies of the last century. This was due to the introduction of the Le Conte variety, which, at the time, was thought to be blight resistant to the pear blight. Commercial pear orchards sprang up as rapidly as propagating stock could be secured, so that many hundreds of acres were planted. These plantings center in southwest Georgia in the vicinity of Thomasville, and for a time the outlook was very encouraging. As these orchards reached maturity, however, they were ravaged by fire blight to such an extent that they were practically annihilated. Many orchards were promptly abandoned from the commercial standpoint and turned out to sod. This sod and lack of culture, by reducing the plant food, enabled the surviving trees to struggle along, producing more or less inferior crops, up to the present time, and remnants of these once great orchards can still be seen as reminders of what the pear industry could be were there a variety resistant to fire blight.

In the early spring of 1912, a series of experiments was started at the Georgia Experiment Station to test the relative resistance to blight, as well as their general habits of growth, of several of the better known varieties of pears. New varieties were added from time to time, to replace those dead from blight. The following notes represent the status of this planting as recorded in 1922: From four to six trees each were planted to the following varieties: B. d'Anjou (on quince), Kieffer (on quince, Garber, Le Conte, La France, Japanese Golden Russet, Tyson, Lincoln, Wilder, Lawrence, Koonce, B. d'Anjou, Blight Resistant (locally known as Pineapple pear), Howell, Flemish Beauty, Buerre Diel, Bartlett, Seckel, Kieffer, Rosney, Sheldon.

Up to September, 1919, the field records of these varieties showed that all the varieties, excepting the Garber, Tyson, Koonce, Seckel, Kieffer, and Blight Resistant, were practically ruined by blight. At that time the Garber, Tyson, Koonce, and Seckel showed more resistance than the Kieffer. The 1922 field records show that all these varieties, excepting the Blight Resistant, locally known as Pineapple pear, have succumbed to blight to such an extent as to eliminate them from commercial plantings. A number of introductions, received from the Office of Foreign Seed and Plant Introductions, of the U. S. Department of Agriculture, have been added to the collection since the original planting. These are yet too young to afford anything like conclusive results, even though some are showing considerable resistance.

The Pineapple, Blight Resistant, or Hybrid Sand Pear

From the standpoint of the experimenter, this pear has been the most interesting of any in the collection. Its varietial name has not yet been settled upon, but the name "Pineapple" has been proposed to the committee on nomenclature of this society. Thus, as a matter of convenience in this discussion, we will designate it as such. The Georgia Experiment

Station received the scions of this pear and made grafts in 1910. The scions were taken from a very large tree growing on the plantation of Mrs. B. N. Stuckey, near Nesmith, South Carolina. This tree measures slightly more than nine feet in circumference one foot above the ground, and has a record of producing more than fifty bushels of fruit in a single season. Its chief and most interesting characteristic, however, is that it is highly resistant, almost to the extent of immunity, to pear blight.

The trees, as grown at the Georgia Experiment Station, have been subjected to the most rigid trials for infection to fire blight. In addition to being grown in a general variety collection where a large percentage of the trees were annually dying from blight, a number of the trees were inoculated with laboratory cultures, but no appreciable injury was ever observed. Even where the inoculation would take effect the organism did not spread enough to do the trees any appreciable damage. The inoculated twig would die back for a few inches, but the disease was not able to spread to any other twig, and was soon overcome. In fact, the variety is so highly resistant that the orchardist may plant the trees without fear of blight. Ten-year-old trees now standing at the Georgia Experiment Station show no signs of blight, even though they have had every chance to become infected.

History of the Pineapple Pear

The exact history of this pear is unknown. However, its general botanical characteristics indicate very clearly that it is a hybrid between *Pyrus serotina* and *Pyrus communis*. Its exact parentage and time of origin, however, will probably never be known. Some have suggested that it is an immigrant from China or Japan. Mr. George D. Lowe, investigating this subject, says, in part: "In the winter of 1888, Dr. C. C. Daniel, a prominent Liberty county, Georgia, physician, drove up to the gate of the John W. DeLoach plantation, some forty miles south of the LeConte place, and now in Long county, Georgia. He handed Mr. DeLoach a pear switch with the remark that he had cut it from the finest pear tree he had ever seen in his life down on the island (near Brunswick, Georgia), advising Mr. DeLoach to set it immediately, which he did. It was placed in a small orchard of blighting Le Contes and Kieffers and grew off rapidly, as the pear always does in south Georgia. It came into bearing the sixth year from the switch and showed quality and productivity beyond expectation."

* * * * * *

"It appears evident that the original Pineapple pear was given to a planter in South Carolina by a relative who was an officer in Commodore Perry's fleet which visited China and Japan in the middle fifties, and brought the rooted pear from China when he returned. The tree now stands still vigorous and in bearing, nine feet in circumference just above the ground and with a tremendous spread of limbs. In its prime, several yields of over one hundred bushels were harvested and last year it bore some forty bushels. Undoubtedly the tree on the Georgia offshore inland came from a cutting sent by some South Carolina relative of the owner.

The South Carolina specimen stands alone in its generation outside of China, so far as close inquiry yet discloses."

A few trees of this pear, up to the present time, have been located in widely scattered places in South Carolina, Georgia, Alabama, Florida and Mississippi. However, no systematic effort has been made to chart its distribution.

Usefulness of the Pear

This pear cannot be classed as a dessert variety. In quality of fruit it would be classed along with the Le Conte and Garber. It is perceptibly better than the Kieffer, though it could not be considered along with such varieties as the Seckel or Bartlett. It is primarily a culinary pear and can hardly be surpassed for preserving, baking, and canning purposes. Canneries report that it brings a premium above the Kieffer when canned and is in great demand by those who consume canned pears.

Description of the Pineapple Pear

Scientific name, *Pyrus serotina x Pyrus communis.*

Common name, Pineapple (proposed).

Fruit, very prolific.

Form, tapering towards both ends, round, often unequal.

Size, large. Dimensions, 3.1 inches by 3.4 inches.

Basin, deep, medium, broad, rounded.

Cavity, shallow, rounded.

Stem, persistent, short, stout, both ends enlarged.

Bloom, moderate amount.

Color, creamy yellow when ripe and greenish tinge when green; few russet spots.

Dots, numerous and raised, russet.

Skin, thick, moderately tough.

Aroma, very pronounced and pleasing. Some find a resemblance of pineapple.

Flesh, firm, crisp, moderately juicy, and coarse grain.

Color, white, translucent, uniform.

Flavor, moderately sweet, and agreeable.

Quality, excellent for canning, preserving, pickling, and for shipping, but poor as a dessert.

Core, large and open.

Seed, large, prominent, chocolate colored, and very few in number.

Tree, upright, slender, branches; very vigorous.

Leaves, large, deep green color, and pointed at the end; finely serrated.

General: Season, ripens during the month of August. Where grown, Georgia Agricultural Experiment Station. Soil, Cecil clay loam. Altitude, 940 to 950 feet. Distinguishing character, blight resistant. Place, Georgia Agricultural College.

NURSERY STOCK INVESTIGATIONS

L. B. Scott, Pomologist in Charge of Nursery Stock Investigations, U. S. Department of Agriculture, Washington, D. C.

Mr. President and Members of the American Pomological Society, I am very glad of the privilege of presenting this brief report on the development of the nursery stock investigations of the United States Department of Agriculture and regret that it was not possible for me to appear and present it in person.

The nursery stock investigations project may be said to be a direct outgrowth of federal horticultural board quarantine order No. 37. This order, which became effective several years ago, prohibits the introduction of ornamentals into the United States except under certain restrictions. As you are aware, a large percentage of our fruit tree stocks are raised in France and Holland and many nurserymen were apprehensive that the quarantine would sometime be extended to fruit tree seedlings. Whether the quarantine could be extended or not, many prominent horticulturists have long felt it was economically an unsound proposition to raise part of the tree in Europe and perfect the finishing timber, so to speak, here. Nurserymen appealed to the department of agriculture for assistance. The department was asked why it did not take up some investigational work with fruit tree stocks, some investigation of plant propagation. The department officials, while appreciating the need for such work, were forced to reply that no funds were available. Then, as a result of the activity of a few leading members of the American Association of Nurserymen, a special item of $20,000 for nursery stock investigations was secured for the fiscal year beginning July 1, 1920. The same amount has been carried in the regular appropriation for the year beginning July 1, 1921, and July 1, 1922. The item reads as follows:

"For investigating, in cooperation with state or privately owned nurseries, methods of propagating fruit trees, ornamental and other plants, the study of stocks used in propagating such plants and methods of growing stocks, for the purpose of providing American sources of stocks, cuttings, or other propagating materials, $20,000."

Our nursery project is administered by the bureau of plant industry through its office of horticulture and pomological investigations. This office is directed by Dr. L. C. Corbett, and during the summer and fall of 1920 the nursery stock investigations were directly handled by Dr. Corbett. He made a survey of nursery practices in England, France and Holland, giving particular attention to the fruit tree seedling industry. The information secured by him on this trip has been of great value in developing the nursery stock project.

The writer was brought back into the department in February, 1921, and placed in charge of this project. The investigational work the first year was conducted at Bell, Maryland, and this last season work was also conducted at Diamond Springs, Virginia, and South Haven, Michigan. The coming year some work will be carried on at Altadena and Shafter, California.

At Bell, Maryland, approximately five acres are devoted to nursery stock investigations; at South Haven, Michigan, about one-half acre is

devoted to nursery stock work, and at Diamond Springs, Virginia, about one-fourth acre. At Bell, Maryland, the work is carried on on land leased by the department of agriculture; at South Haven, Michigan, the work is developed in cooperation with Prof. V. R. Gardiner, head of the horticultural department of the Michigan State Agricultural Experiment Station, and at Diamond Springs, Virginia, in cooperation with Prof. T. C. Johnson, director of the Virginia Truck Experiment Station. At Altadena, California, the work will be developed in cooperation with Mr. C. S. Milliken, manager of the bud supply department of the Fruit Growers Supply Company of the California Fruit Growers Exchange, and at Shafter, California, in cooperation with Mr. W. B. Camp, agronomist in charge of the United States experiment farm at that point.

Associated with the writer in the nursery stock project are: Mr. G. E. Yerkes, assistant pomologist, who is in direct charge of the nurseries and the experimental work in propagation; Mr. Charles Swingle, junior pomologist, who assists in the work at Bell and Diamond Springs; Mr. M. L. Hancock, who is also located at Bell; Mr. Stanley Johnson, superintendent of the branch station at South Haven, Michigan, who has charge of the experimental work at that point, and Miss Clara Ballard, who is compiling notes on propagation from old files of the Florists Exchange, Gardeners Chronicle, and similar publications.

In addition to the investigational work, an attempt is made to maintain the closest cooperation with the nursery interests of the country. During the last two years most of the important nurseries in the United States have been visited by some member of the staff and their propagation methods studied.

The nurserymen are keenly interested in the department's work, and in order to bring about a closer cooperation between the nursery interests and the department, the American Association of Nurserymen has a standing advisory committee for our nursery stock work. The members of this committee this year are:

Henry Chase, chairman, Chase, Alabama.
F. A. Wiggins, Toppenish, Washington.
H. Harold Hume, Glen St. Mary, Florida.
E. S. Welch, Shenandoah, Iowa.

The leading activities, or sub-projects, we are developing might be listed as follows:

(1) The raising of fruit tree seedlings;
(2) The vegetative propagation of fruit tree stocks;
(3) Rose stock investigations;
(4) Propagation of ornamentals;
(5) Furnishing information regarding propagation.

As this society is primarily interested in fruits, we will confine our report to a brief review of the work carried on under our first, second and fifth sub-projects.

As pointed out before, a comprehensive study of practices used in France and Holland by fruit tree seedling growers was made by Dr. Cor-

bett in 1920. This was supplemented by studies of American methods in the Kaw valley of Kansas, in Washington, Iowa and Minnesota by the writer and his associates in 1920 and 1921.

Blocks of apple seedlings grown from different sources of seed were purchased in the spring of 1921 and lined out at Bell, Maryland. These included:

(1) Imported French crab seedlings;
(2) Kansas-grown seedlings from imported seeds;
(3) Minnesota-grown seedlings from Minnesota seeds;
(4) Pennsylvania-grown seedlings from Pennsylvania seeds;
(5) Kansas-grown seedlings from Vermont seeds;
(6) Iowa-grown seedlings from French seeds;
(7) Iowa-grown seedlings from Minnesota seeds;
(8) Iowa-grown seedlings from Vermont seeds.

Judged by their behavior in 1921 and also the behavior of smaller blocks in 1922, the seedlings which appear to be the most vigorous and make the best growth are:

(1) American-grown seedlings from American seed;
(2) Imported French seedlings;
(3) American-grown seedlings from French seed.

This year a smaller block of two-year-old seedlings was selected. These were originally raised at Hamburg, Iowa, were in the general study block at Bell last year and lined out in comparative rows this year. They included:

(1) Iowa seedlings from French seed;
(2) Iowa seedlings from Minnesota seed;
(3) Iowa seedlings from Vermont seed.

These were budded about the first of May to the following varieties:

(1) Northern Spy;
(2) Baldwin;
(3) Jonathan;
(4) Stayman Winesap.

When last observed by the writer, about September 10, the difference in the rate of growth was very striking; all the varieties budded on the seedlings raised from Minnesota and Vermont seeds were making a more vigorous and better growth than those on the seedlings raised from French crab seed.

In addition to these larger seedling blocks, open-pollinated seed of a number of named commercial varieties has been secured and small blocks of seedlings raised. Up to date, the two varieties which have been the most outstanding as giving the highest percentage of clean, straight-rooted seedlings are Tolman and McIntosh. This work with seedlings of named varieties is being continued on a much larger scale this year. Seedling plantings will be made at Bell, Maryland, and Shafter, California, and will include seedlings of about twenty named varieties of French cider apples and about twenty or twenty-five leading American varieties.

The work up to date has shown, as was to be expected, that there is a marked variation in vigor, habit of growth and root development of open pollinated seedlings of different named varieties.

It is at once apparent, that even with the prices which are now paid for seedlings, it is practically impossible for the average seedling grower to secure an adequate amount of seed of any one or two varieties. Because of this fact it was felt that it was worth while to give considerable time to the possibility of vegetatively propagating fruit tree stocks.

The propagation of certain pears in the southern states by hardwood cuttings was a general practice a number of years ago. Apples have been propagated in this way by different investigators, but with more or less indifferent success. Softwood propagation is not only feasible for certain classes of plants, particularly some of the citrus hybrids, but has been demonstrated by Dr. W. T. Swingle and Mr. T. R. Robinson, of the office of crop physiology and breeding investigations, United States department of agriculture, to be commercially practical. Layering has been practiced in many places as a method of direct propagation. All of these methods were similar in one respect, that is, a part of the plant which grew above the ground was used.

We have found that very good results can be secured by propagating from root cuttings. From 5,000 Yakima apple seedlings root cuttings were made this last season and in the neighborhood of 100,000 plants were raised from these root cuttings. The cuttings from seedling roots which appear to make the best growth are those about one-quarter inch in diameter and three inches in length. The cuttings were made in February and March and planted at Bell, Maryland, Diamond Springs, Virginia, and South Haven, Michigan, in March and April. They were planted in the open in nursery rows, in a vertical position and buried to a depth of about an inch. Buds develop and shoots push through the ground in three to four weeks' time. As these shoots develop earth is hilled up around them. Roots form on the new growth and on the original cuttings. The shoots made a sufficient growth so they could be budded about September first and the rooted shoots containing the dormant buds can be removed this fall and lined out next spring. The shoots which were not used as budding stocks can be used for whole-root grafts this winter. The original root cuttings are allowed to remain in the ground, as it is found they send out even stronger shoots the second year than the first. This method has proven equally as efficient with Mazzard, Myrobalan, Almond, Sour Orange, *Pyrus ussuriensis* and *Pyrus calleryana.* With the latter two species it seems to offer wonderful possibilities. Prof. F. C. Reimer, superintendent of the Southern Oregon Experiment Station, Talent, Oregon, has found in his work with both of these species that there are certain seedlings which he has not been able to inoculate with pear blight. In other work he has seedlings which for commercial purposes may be said to be immune to blight. By propagating by root cuttings these resistant individuals can be multiplied. We are developing our work in close cooperation with Professor Reimer and hope this season and in the following years to arrange for an extensive propagation of his blight-resistant seedlings at our field nurseries.

It has been found in extensive observations made at nurseries in different locations that many grafted trees develop roots of the variety above the graft union. At the present time own-rooted trees of approximately fifty named varieties of apple propagated by root cuttings are being grown at Bell, South Haven and Diamond Springs.

In addition to these major projects, we are securing some readings on the behavior of certain types of *Prunus hortulana* and *Prunus mexicana* as stocks for peaches and plums. Through the courtesy of Mr. John Dunbar and Mr. B. H. Slavin, of the Rochester, New York, Park System, there has been placed at our disposal their entire collection of these species. In cooperation with Mr. H. E. Hamilton, of Tallahassee, Florida, we are testing different types of Peento peaches as possible peach stocks for the southern states.

When the project was first started, it was found there was no satisfactory file of propagation notes available. The requests for information regarding methods of propagating different plants are so varied that it was decided it would be well worth while to gather together from old papers, such as the Gardeners Chronicle, Florists Exchange and similar publications, any notes which might have a bearing on plant propagation. This information is of particular value in answering requests on the propagation of ornamentals. Short circulars dealing with the general subjects of the raising of apple, pear, peach and plum seedlings have been prepared. These are found to be a great aid in answering correspondence.

In conclusion, may we say that in this paper we have attempted to summarize a few of the things we are attempting to do in our nursery stock investigations. The work is being developed in the closest cooperation with the nursery interests of the country. The investigations are still in their infancy, but we hope that from the lines of work now under way something worth while may be learned.

THE QUESTION OF ROOTSTOCKS

W. L. Howard, Professor of Pomology, University of California, Davis, California

In all countries where fruit growing has advanced beyond the seedling state, the question of rootstocks has been given more or less attention. Taken as a whole, the United States has probably paid more attention to rootstocks than any other country. This is because fruit growing is more of a main business with us. In France, Italy and Spain—countries we are apt to think of as great fruit producers—the growing of fruit trees is mostly a side line to general farming. The almond business of Spain and Italy, and the walnut industry of a certain limited section of France, come very near being what we would call on a business basis, in that the trees are not only budded or grafted varieties and planted in orchard form (that is, rows both ways), but the owners depend upon the produce of their trees for a living. Even in the almond and walnut orchards other crops are grown to a considerable extent, but here these inter-crops are the side issue.

The vineyards of all western Europe occupy all the land on which they are grown and no other returns are expected from the soil except the produce of the vines. This makes the grape growers, then, about the only honest-to-goodness fruit specialists of the continental part of the old world. And these grape producers know a lot about the best stocks for their vines, too.

There are two main reasons why people become interested in the kinds of rootstocks they are using. The first of these is the extent to which they are specializing and the second, and most important, is the cost of the land. It makes a lot of difference whether the orchard land cost twenty-five to fifty dollars an acre or five hundred to a thousand. High priced land makes high-class farming a necessity. If a bearing orchard is valued at $200 to $300 an acre, it may not be a vital matter if every tree does not thrive and produce to full capacity, but where the orchard is valued at $2,000 per acre and more, it is real tragedy for the owner if a single tree is lost or a few fail to thrive.

In most parts of the United States the rootstock question is given but little attention, chiefly because land values are relatively low, and because long experience has shown that the stocks chosen by the nurserymen make trees that are as successful as their purchsers expected them to be. In other words, the standards are rather low all around. Of course it must not be forgotten in this connection that the apple and peach—the principal fruits grown east of the Sierras—come nearer having standardized rootstocks than any of the others, and come nearer to doing well on these stocks in all localities and sections than any other fruits, but even they may have their troubles that might be remedied by a study of the rootstock question.

For instance, we have for decades and generations been securing the major portion of our apple stocks from France. We have always called this stock the "French crab" and knew in a general way that it came from seedling apples grown for cider purposes. And we have always thought that these cider apples, like all the apples we knew anything

about, were rather carefully selected for their purpose and therefore fairly true to type. Also we thought they were grown on the hallowed soils of France.

In the first place, the cider apple orchards of any country consist of trees that are very unlike in vigor, habit of growth and the kind of fruit they produce. In general appearance the apple orchards of Normandy and Brittany in northern France look much like the orchards of many of our experiment stations where scores, if not hundreds, of varieties are being tested and scarcely any two looking or behaving alike. The trees are not only very different in appearance, but they bloom from early May until July and the vari-colored and diversely shaped fruit ripens from June until October.

Furthermore, much of the apple stock we have fondly believed came from France did not grow in France at all, but came from Austria. How much of it has come from Austria and how long it has been coming, I do not know, but I do know a big Italian firm has been collecting both apple and pear seeds from the province of Styria in Austria for years and selling them to French dealers who resold them to nurserymen and dealers in the United States. Whether this stock is better or worse than the French grown article, I cannot say, but from the standpoint of uniformity, I am sure it cannot be any worse. When I was in Italy in the summer of 1921, I wanted to go on into Austria to see the apple and pear orchards from which the Italian firm I was visiting collected their seeds, but conditions were very unfavorable for traveling in that country at the time, so I did not go. However, my Italian friends declared they looked very much like the French orchards and I had to let it go at that.

From what has been said, does it not seem reasonable that there is a real rootstock problem with apples for every part of the United States wherever apples are grown if someone cares to take it up? And the same is, no doubt, true of pears, but in less degree.

In California, the rootstock problem with stone fruits and pears has been acute for some years, but it is only recently that the question has been taken up for careful study. The California growers specialize to a high degree and they all operate on high priced land. The pear stock we need is one that is resistant to the pear woolly aphis, immune to the root disease known as oak fungus (Armillaria mellea); blight resistant—that is, will not permit the blight to pass from the tree into the roots nor throw up sprouts to be attacked by blight; a stock that can stand a wet soil; and, finally, which makes a good union with our principal variety, the Bartlett.

The so-called French stock is practically immune to the oak fungus disease, stands a wet soil and makes a strong union with the Bartlett, but it is very suspectible to blight and is severely injured by the woolly aphis. Our growers are now using as a substitute the so-called Japan stock (Pyrus serotina), and while it seems to take the Bartlett graft well and resists the woolly aphis to a marked degree, it is by no means blight resistant, does not do as well as the French in wet soil, and last, but not least, is subject to oak fungus attack. Professor Reimer of Oregon is doing some good work in testing out several promising types and species, including a number of Manchurian forms.

For peach stocks, Pacific coast nurserymen have long been using seeds of the Salway and Muir varieties, but they are not agreed as to which is the best. And now that the nematode, or eel-worm, is beginning to do so much damage to peach roots in some sections, there is a grand rush to find some other stock than the peach root that will resist the attacks of this organism. The apricot is promising, as it is not attacked, but, unfortunately, does not always make a good union with the peach. To use it may necessitate double-working with Almond, Myrobalan or Sugar prune as the intermediate stock. The peach and all other stone fruit rootstocks tried are very susceptible to oak fungus attack. The Myrobalan is the most resistant of any tried, but it is far from being safe.

Our cherry rootstocks are far from satisfactory. Some think Mazzard is the best for the sweet cherries and some—a small minority, favor the Mahaleb. There is a tendency now in some quarters to use the Morello. While in Europe last year I investigated the sources of our cherry seed supply. The French dealers have not been sending us the wild Mazzard, as we believed, but have been sending a miscellaneous collection of seeds from cultivated varieties. The supply of wild Mazzard trees in Normandy is entirely too small and yields only a fraction of the seeds we use. This may account for the great lack of uniformity in the behavior of our trees on that stock.

The wild Mahaleb cherry trees of the Rhone valley in southwestern France are used as hedges to subdivide the grain farms and there seems to be enough of them to supply all our needs for a long time to come. Where trees were allowed to grow without being headed back for hedge purposes, they were from twenty to twenty-five feet tall and a foot in diameter. Apparently they should not exert a serious dwarfing effect on sweet cherries unless the Mahaleb growth is too slow. Neither the Mazzard nor Mahaleb is resistant to oak fungus and neither can stand a wet soil. In a wild state the Mahaleb is able to thrive in very dry soils. I have never seen a wild Mazzard growing in any but a deep, moist, but well drained soil.

The Myrobalan or cherry plum is the chief rootstock for plums and prunes everywhere and, on occasion, may serve for peach and apricot. I found that practically all of the Myrobalan seed supply for both Europe and America comes from a rather limited region about thirty miles west of Venice in Italy. Nurserymen have known for a long time that there is considerable variation among the Myrobalan seedlings, but I was scarcely prepared to find seven or eight different types of fruit ripening over a period of two months and twelve or fifteen different types of seeds. The parent trees did not seem to exhibit any marked differences in size or vigor, but this was hard to determine, as they were always found growing in gardens among plums, prunes and other fruits and always crowded so that every tree had to grow tall to get its share of light.

The California Experiment Station has a comprehensive rootstock investigation under way which includes studies of all the questions mentioned in the foregoing pages and also many other problems, such as affinities and adaptations of species and varieties to widely differing soil con-

ditions. So far the northern California black walnut, the black fig and the French pear are the only stocks that successfully resist oak fungus and the fig and *Prunus Davidiana* are to a high degree tolerant of alkali. The latter is a good peach stock.

Pacific coast nurserymen are more and more inclined to grow their own Myrobalan plum seed. All over California there are scattering Myrobalan trees that have been allowed to grow after some accident has happened to the prunes. They can always be depended upon to bear and as seed collectors are bidding high for the fruit for seed purposes, the trees are as profitable as prunes. However, it is realized if we are to grow our own seed supply, it is very important to select only the best types from every viewpoint. This is one of the lines of study now under way.

We are also making a wide study of wild forms of plums and cherry species in the hopes of eventually finding something that will not be attacked by oak fungus. Such a stock need not necessarily be satisfactory in other respects, except that the graft union with the variety must be reasonably strong. Now, when a stone fruit tree dies from oak fungus, there is no recourse except to plant a pear, walnut or fig and the average prune grower, for instance, does not want either of these trees in his orchard. Most of our growers would be perfectly willing to pay several dollars, if necessary, for a tree, if they were assured they could safely replant the prune or cherry tree in the holes where the others have died. Therefore, to the Pacific coast grower, one of the most important rootstock questions is to find something for the stone fruits that will resist this dread disease. For the rest of the United States, perhaps the question of hardiness, or ability to resist low temperature, would be the greatest single factor of interest in connection with rootstocks.

THE DRIFT AND DEVELOPMENT OF SPRAY PRACTICES IN AMERICA

Leroy Childs, Superintendent Hood River Experiment Station, Hood River, Oregon

The subject that has been given to me, "The Drift and Development of Spray Practices in America," is one that I sometimes feel is a little too general to permit of comprehensive discussion on my part, as my investigational work only covers a period of some ten years, confined entirely to the problems of the extreme West and largely to spraying of apples and pears.

If you will permit me to hark back to the first feeble attempts to control insect pests and plant diseases, we find that man has been combatting insects and plant diseases as far back as we have records of plant cultivation. Available records show that these early attempts in fighting these various "plagues" and "blights" were accompanied with varying results. Up to 1860 the control of the enemies of cultivated plants was dependent largely upon the ingenuity of the gardener or orchardist who possessed no technical knowledge of the behavior or life history of the pest to be controlled and ofttimes no very great knowledge of the behavior of the material with which he was using. These ancient entomologists and plant pathologists more often than not trusted in the material with the most ill smelling odor for results. Often very startling results in successful control were recorded and only by further trials were found to be wholly lacking in their supposed powers of control. However, out of this cut and try process, carried on over a period of many years, came many important discoveries. The year 1860 appears to be an approximate dividing line between what might be termed ancient and modern methods of fighting plant pests. Up to this date materials were used which appealed largely to the senses. After this came the testing of many chemicals, regardless of odor. At this time sulphur was used extensively for mildews and available insecticide of the times consisted of various forms of soap, quassia chips, tobacco and carbolic acid.

The year 1880 saw a rapid expansion in the knowledge of insecticides in America. The ravages brought on by the potato bug, codling moth and other leaf eating insects made their control imperative, if the farmer and horticulturist was to succeed. Well do I remember the late Dr. A. J. Cook tell his first experiences in controlling calyx worms in apples with Paris green. This was done in 1880 and the spray was applied with an ordinary syringe, as up to this time spraying as we understand it was not practiced. Insecticidal and fungicidal materials were "syringed" upon the plants by using an instrument of construction similar to the ordinary syringe. Other early methods of application consisted of washing the plants with the liquid or by throwing it on to the surface through the use of a sort of whisk broom. This latter method of application was generally practiced largely by gardeners and greenhouse men. Later an improved brush was developed, consisting of the ordinary brush with a tube leading in at the top and fed by gravity from a tank of spray liquid carried upon the operator's back. Watering cans with fine holes

through which the spray materials were sprinkled was also one of the early methods employed in controlling pests on low growing plants. This method of application, though quite successful in destroying the pests, was decidedly wasteful of materials.

The period of years, 1880 to 1895, was one of rapid development in spraying equipment, both in Europe and America. The syringe was rapidly followed by Whitman's fountain pump, the "E'clair" knapsack pump, "Galloway" knapsack pump, barrel pump, pneumatic pump and the geared spray pump. The geared machine was the first to derive its power other than by hand and dates back only 32 years. In 1894 the first successful steam power sprayer was manufactured. It was possible to develop an unheard of pressure, 125-200 pounds, with this outfit, but owing to the fact that hose construction had not been improved, 100 pounds pressure was about all that could be satisfactorily used. In 1895, or 27 years ago, an orchardist in California employed the first gas engine successfully as power for applying spray. It is reported that this machine developed 200 pounds pressure, employing bamboo spray rods, and was in fact a machine very similar to that found in operation in many orchards today. The one great step forward since this time has been the development of the spray gun.

Similarly, we also find activity in the development of dusting methods, hand bellows, powder guns and finally our up-to-date power duster. Throughout this period much ingenuity was shown in the manufacture of spraying nozzles, all contributing to the perfection that we have today.

No improvement of a fundamental nature occurred in the application of spray until the appearance of the spray gun. In 1916 this new device first came to the attention of horticulturists generally, and during the year 1917 our station carried on its first work to determine the relative merits of the spray gun used on various outfits of different capacities. At the same time we were also carrying on parallel tests with different combinations of dust and comparing therewith the results obtained, where the old familiar method of spraying with the twelve foot rods was used.

Before summarizing these results, it might be well to discuss briefly the condition under which these experiments were applied. Typical orchard conditions prevailed in a typical fruit growing section of the West. The tests were all carried on with standard equipment of various capacities and the materials used were those made by manufacturers of repute. These are fundamentals which, I believe, are often overlooked by many investigators who working at some college or station outside a typical fruit growing section are forced to draw conclusions based upon results obtained from the use of inferior equipment. This condition of affairs is probably largely responsible for many unexplainable conclusions drawn. If we glance over the literature published during the past 10 years on the subject of spraying and dusting and correctly analyze the results obtained and recommendations issued, we are impressed with the varying opinions presented. The investigators' interpretations are those based upon the results obtained with the particular outfit employed and under the existing conditions present, either favorable or unfavorable, typical, or irregu-

lar, and these conclusions may be far from what they would have been had more nearly standard equipment been employed and more typical orchard conditions been present in which to carry on the investigation.

Of course it is a recognized fact that conditions vary to such an extent that recommendations workable in one section may not be so in another. One of the more recent points of interest along this line, and one which undoubtedly influences our spraying results, with lime sulphur in the control of scab, has just been pointed out by Doran[1], of New Hampshire, following a careful study of the toxicity of lime sulphur to the apple scab fungus. He has found that "Commercial lime sulphur solution at dilutions of one part in forty parts of water or of one part in ten parts of water does not prevent germination of the Conidia of *Venturia inaequalis*, when sulphides are absent." "Calcium polysulphide decomposes most rapidly and decreases in fungicidal efficiency most rapidly when the sprayed surface dries slowly." He also found that sulphur was toxic to the Conidia of the apple scab fungus when the temperature remains at 26.0 degrees Centigrade for five hours. He concludes, then, in referring to average temperatures "that results obtained in other sections of the country, sulphur fungicides would be less effective in Nova Scotia than in New Hampshire and less effective in New Hampshire than in Virginia." We need much more investigational work of this type in order to clear up the irregular results that are continually occurring. As I have mentioned before, some of the conclusions seem to be incorrect, due to the fact that these results are based upon data that are not comparative or are not sufficiently extensive to permit the drawing of conclusive results. Thus, for example, we find some investigators reporting better worm control with the spray gun using a pressure of 100-125 pounds than with high pressure. In analyzing their tests, we find that they do not have available a sprayer which can be considered a high pressure outfit. The conclusions are then drawn that the gun is more effective at low pressure than at high pressure and brings about much confusion, particularly in the minds of orchardists. We also find some very irregular results presented from tests made with the various dust mixtures. Over-enthusiasm based upon incomplete evidence has resulted in the expenditures and loss of much money. This, perhaps without probable ultimate good, for it has stimulated much activity and interest in this particular method of controlling plant pests and which probably would not have been undertaken for many years without the incentive given.

With the appearance of the spray gun in 1917 and the already expressed interest on the part of the growers in the dusting method for controlling the codling moth and apple scab, it became imperative that our station find out the merits of these two methods of apple protection as compared to the old established method of applying sprays with a three or three and a half horse power outfit with twelve foot rods.

In view of the fact that there appears to be a question in the minds at the present time of many growers, especially here in the Mid-West and East, and I believe in the minds of some of our investigators, concerning

[1] Laboratory Studies of the Toxicity of Some Sulphur Fungicides. Wm. L. Doran. Tech. Bul. 19, New Hamp. Agr. Exp. Sta. 1922.

the practicability of the spray gun, it might be well to briefly discuss the results of some of my work, even though some of this has already been published. The work was conducted on an extensive scale, typical orchard conditions prevailing, and during much of the time over which the tests ran ample infestation and infection occurred to permit the drawing of definite conclusions. Assembled for the work was a 1½ to 2 horse power outfit, a 3½ horse power outfit and a 10 horse power outfit. The dusting work was conducted with two large power dusters of well known make. The effectiveness of the gun on each of the sprayers was checked against blocks in which dust sulphur and lead were used. After carrying on these dusting tests three years, we are able to conclude that dust properly applied would control codling moth at Hood River to a degree comparable with spray properly applied from either a spray rod or gun; and also that scab was controlled, though not as effectively as the codling moth. Dust, properly applied, is a term that must not be misunderstood. The trees during the period of investigation were dusted six and seven times each season under absolutely favorable weather conditions. Nearby growers were dusting the same years. Wind was disregarded by them. Results in the experimental orchards showed worminess in the amount of 1.9% to 5.37%, depending upon the year of application and the orchard in which the work was done, while the growers were losing from 25% to 35% of their fruit on account of worm infestation. Continuous winds occurring during the spring over most of the Northwest make thorough dusting impossible. The experimental work was actually done about 4 to 6 o'clock in the morning, at which time quiet prevailed. Dusting was also found to be more expensive and its general utility limited because of the presence of several pests that could not be controlled in this way.

The results obtained with the spray gun used under the conditions already mentioned permitted the drawing of many useful suggestions and recommendations. We can state emphatically and without reservation that the gun cannot be used on every spray outfit. The dissatisfaction existing among growers today is probably due largely to the fact that these growers have tried to use them under all sorts of conditions. It appeals to them because of the ease of operation and the speed with which spraying can be accomplished. In fact, many have followed the lines of least resistance, have used the gun, disregarding entirely the fundamental principles that must be present in order to obtain the benefits that this instrument offers. For example, in looking over our results in controlling the codling moth, we find that the gun operated on a 1½ horse power outfit has been very poor. Our analysis of these results obtained on trees so sprayed show that fair control was obtained in the lower portions of the trees and very poor control in the tops. In one experiment we found 3.5% damage in that portion of the tree from the ground to twelve feet and 17.8% damage above this point. Generally speaking, providing thorough, well timed spraying has been done, there are two reasons, either one of which would bring about the above type of control. The average 1½ horse power outfits have a pumping capacity of not to exceed 4 or 5 gallons of spray per minute and the pressure that it can maintain is limited, probably not more than 200-225 pounds on the aver-

age, without killing the engine. The grower then follows one of two courses, he either cuts down the size of the disc in his spray gun in order to get a finely divided spray, or he uses a fairly coarse spray in order to keep his engine running and in order to finish his job in a hurry. Both of these combinations will bring about the degree of worminess cited above. The reasons are these: where the fine disc is used and the fine spray employed from a small outfit, the discharge is very limited—one to three gallons per minute. The sprayer salesman says, "Sure, this rig will hold 300 pressure and will operate two guns." However, if one will put the nozzle in a milk can and measure the discharge it will be seen that capacity and with it working radius has been sacrificed for the 300 pounds pressure. This set of conditions is productive of very poor results unless extreme care in spraying is practiced, an act not yet learned by a large percentage of fruit growers in the country. I am firmly convinced, after carrying on numerous tests and observing many growers operating two guns on 3½ horse power outfit, that herein lies their trouble and a set of conditions which had not been favorable to the use of the spray gun. To growers who must use this type of outfit my advice is, use one gun only; employ a disc in the nozzle through which about 5 gallons of spray is discharged and try to keep the pressure as near 300 pounds as possible; go back to the rods if your sprayer cannot be made to meet these conditions.

The spray gun was first made to be a part of a high powered outfit, and there it rightfully belongs. Adoption to small outfits was not in the minds of the originators of the spray gun and the orchardist who has used it with poor success should, in all justice to the spray gun, shoulder the blame. Our station began testing these new high pressure machines for our various apple orchard ailments shortly after their first introduction. Right from the start the gun has given a good account of itself. This larger outfit, taking into consideration its greater cost, can be operated just as economically as the smaller rigs and at the same time cutting the actual spraying time nearly in half, thus making available much time for orchard work other than spraying. It has been found no more wasteful of materials, in fact, we have much information that leads us to believe that it is less wasteful of spray materials, than small outfits when the spray is applied with experienced gun men. In our experimental work results in controlling codling moth have, in most cases, been superior to that obtained with the spray rods. The control of other orchard troubles obtained by orchardists using high powered outfits has been more complete with the gas than was obtainable with the rods. The work has been more thorough and much more readily accomplished.

During the past summer, we carried on tests to determine the size of openings in the discs that should be employed in the spray gun for best all around results in applying spray. This, taking into consideration both economy in the usage of material and also the speed and effectiveness of the application, is a point of much importance to growers. Our earlier observations have led us to believe that the right type of spray is one that is very finely divided and ejected from the gun at a relatively high pressure in order to obtain this particular division of spray; suffi-

cient volume must be thrown from the gun to enable the covering of the higher portions of the trees. In order to obtain this, as well as the fineness of the spray, it is necessary to have a fairly large opening in the disc of the nozzle and also a machine of sufficient capacity to maintain the necessary pressure. After several years of observations and field tests, we have found that 300 or 325 pounds is necessary to operate the spray gun satisfactorily. We have also observed that the average operator can handle five or six gallons a minute (provided the above conditions are employed) economically.

Many growers, due to the fact that they have tried to adapt the spray gun to their small outfits, have employed small openings in the discs of their guns in order to develop a finely divided spray. In so doing, a pressure of 300 pounds or such a matter is obtained, but due to the fact that the opening in the nozzle is reduced so greatly, volume as well as spraying radius is greatly reduced. The result has been that we have found it not only takes a much longer time to spray, but also that this practice has been responsible for the development of much worminess and other troubles in the higher portions of the trees. Western apple growing sections are inclined to be quite windy during the spraying season and as a result a volume of this sort cannot be used and the upper portions of the trees satisfactorily covered.

In order to find out the amount of spray that could be forced through nozzle openings of different sizes, a series of tests was made. In doing this work a Bean Super-Giant Junior sprayer was employed. Two fifty-foot ⅝ inch hose were employed to which were connected Friend guns. At the end of each hose a tee was placed in the coupling and a pressure gauge was attached in order that the pressure could be determined for each gun and checked up with the pressure gauge on the machine. These were tested and found to read approximately the same as before the tests were begun. The engine was run at a speed of about 800 revolutions and the pressure regulator on the machine was set so that the gauge ranged between 325-350 pounds pressure. The approximate pressure registered at the end of the hose was found to be 300-325 pounds.

In determining the capacity, the guns were opened wide and the spray discharged into a barrel. The material was measured out and the output determined. Each test covered a period of five minutes. The following openings in the discs were employed: 1/16 inch, 3/32, 7/64, 1/8, 9/64, and 3/16. Two guns were used on the machine in all of these tests. It was found that an overflow occurred in each case, with the exception of that where two discs possessing 3/16 inch openings were placed on the guns. In this case, the capacity of the machine was not sufficient to maintain both of these. A further test using one gun with 3/16 inch opening was employed. It is interesting to note that though a pressure of 300-325 occurred at the machine, but slightly over 250 pounds pressure occurred at the nozzle. This was true, regardless of the fact that a fairly good overflow occurred and the gun employed not more than 2/3 of the capacity of the outfit. It was found that the average discharge from each gun where the 1/16 inch disc was employed was but 1.37 gallons per minute. This was a very finely divided spray, but lacked the

carrying quality and volume which would make it a spray of any great importance. An average of 3.1 was thrown from the disc with the 3/22 inch opening. This was also a very finely divided spray, but lacked the volume to enable thorough spraying in the tops of large trees. The overflow in both of the above cases was very great and showed that it would not be a good practice to operate a machine of this capacity and use so little spray. In the case of the 7/16 inch disc, an average of 4.5 gallons per minute occurred for each gun. This was a very good spray, with much better volume than either of the above. The overflow, however, was much more than was necessary as far as the economics of operation involved was concerned. From the 1/8 inch disc an average of 5.72 gallons per minute resulted, while the 9/64 inch disc averaged 6.62 gallons per minute. In the case of the overflow of these two sizes, a fair discharge occurred in the former, while in the case of the latter, the overflow was slight. From the standpoint of economics of operation in the case of a machine of this capacity, the results would indicate that the choice of a disc should be between these two sizes in order to obtain the most economical usage of the machine. Six gallons a minute is perhaps more spray than the average man can handle judiciously. An active man, however, should be able to use 5 gallons very effectively and at the same time with little waste. Of course it must be considered that these figures are for continuous flow and the operator can not only cut off his spray entirely, but can also reduce the use when spraying the lower portions of the trees. There is need at times for a capacity of this amount and when needed it should be available in order to hit the tops of the trees. This is not the case if the gun is throwing 3 or 4 gallons a minute or less. The test shows that the capacity of the machine was 15.2 gallons and that it was unable to operate two 3/16 discs at a 300 pounds pressure. Where these were employed the pressure ranged between 200-225 pounds at the machine and 150 pounds at the nozzle.

Generally speaking, my paper has discussed the past and present spraying practices in a rather hurried fashion. What is there to be accomplished in the future, not only from the standpoint of the development of new sprays, new methods of applications, but what I consider more important to the orchardist, carrying out what we already know so that he may be more completely benefited by this knowledge. There are so many growers who are so far away from immediate contact with reliable information during the critical spraying season that it is no wonder they experience much difficulty in producing clean fruit. Hood River is a highly specialized apple growing district of no very great extent. The apple district is closely and definitely defined. The growers for the most part are eager to learn and take advice with reference to their spraying practices. Along with my experimental work, I have made it a point each year to work out the life history of the codling moth and study the spore discharge of the apple scab fungus in order to make our spraying programs adaptable to the yearly behavior of these pests. This direct contact has been productive of much benefit. Regardless of the fact that our weather conditions are such as to make our insect and disease control more difficult than many of the western apple districts the

persistent following of schedules has made possible the production of a very high percentage of insect and disease free fruit. At the present time much of the advice given to growers with reference to their sprays and spraying problems come through the county agent. Usually the agent is primarily not an entomologist or a plant pathologist and in fact seldom can he be classified as a horticulturist. Though he does the best he can for the fruit men, he lacks the fundamentals in the subject of pest control and what is more important the necessary time to give to this subject. It takes much time and work as well as experience to correctly work out these problems. Based on the several years' observations that I have made in arranging spray dates and schedules for fruit growers the more convinced I am of the importance of this sort of work. If more complete application of our present understanding of sprays and spraying practices is to put to use in the greater part of the fruit growing sections of the country, it will have to come largely through the activities of trained men whose special duty it will be to know the seasonal activities of the different orchard pests and possess this information in sufficient time to make it of value to the fruit growers. A man capable to handle such a position can not be picked up every day. He must have much training and experience, not only in entomology, plant pathology, but in horticulture as well. Many of you men who have not lived and worked on the firing line with growers, perhaps do not realize the importance of these qualifications. We continually see young, untried men go to the field and even though their training is of the best, they are unable to meet the orchardist on the same plane. The resulting contact is not one of permanence either to the investigator, the orchardist, or the institution he represents. It should be the duty of teachers in our agricultural colleges to specially prepare men who can do work of this sort. They should primarily be men originating from the farm. They and they only for the great part, possess the farm instincts and behaviors making a contract possible. The average farmer and fruit grower instinctively knows whether the man he is talking to knows the game with its hardships and its ups and downs, or does not know it. This will be the type of man who will carry out the information and materially increase the orchard productivity of the country.

We, as investigators, have almost an unlimited field ahead of us. We, like our predecessors, are for the most part cutting and trying. For reliable insecticides and fungicides we have a list of materials that can be counted on the fingers of two hands; more commonly used ones almost on the fingers of one hand. Our good entomological and pathological investigators are not chemists. Our good chemists are neither of the above. All too often plant physiology is a foreign subject for the most part to all three. The drift at the present time is for closer team work with these three groups of workers and out of it will come much improvement in our understanding of sprays and spraying practices.

Question: What material do you use in the first dormant spray in the first of March for scab?

Mr. Childs: Lime sulphur, one to twenty-five.

That is a point that we have been working on the last few years. We started off using lime sulphur about one to fifteen. But since then the work has indicated that we can materially cut down that strength. Personally, I feel that one to forty would be just as effective for scab as one to twenty-five. But, of course, when you have scale, you have to use a dormant spray or increase the strength in the delayed dormant spray.

Question: Why do you use one to twenty-five?

Mr. Childs: That hasn't been determined. I personally use one to forty. But I recommend one to twenty-five, because I am not yet sure.

Member: I would like to know which you would prefer in controlling the scab in your own instance, the dust or the liquid?

Mr. Childs: I would take the liquid myself. I would apply it with a spray gun on a big outfit. And I am sure that year in and year out I would get better control.

Mr. Sharp: Is the lime sulphur as effective as bordeaux?

Mr. Childs: Well, we discarded bordeaux because of rusting. We are really confined to lime sulphur.

I might say that I consider lime sulphur the weakest spot in our whole spray program at the present time. Lime sulphur is a good fungicide, but it is a dangerous one. And I am looking forward to the time when we will have a substitute for lime sulphur which will be much more safe. Under certain conditions in Hood River, and I know it is true in other sections, we often get a severe defoliation from its use, severe foliage burning.

The Chairman: Under just what conditions?

Mr. Childs: Well, the combination under which lime sulphur burns with us is during the period of cloudy, damp weather. In bright, sunny weather things will come along fine, but, of course, that is the condition when you don't need to spray so much. It is the damp, cloudy weather during which the spores of scab are being thrown off and are active.

Question: Does lime sulphur have any effect on causing drop?

Mr. Childs: It causes some drop. We have never had sufficient drop to be really alarmed about that. But it will cause drop, and for that reason I, personally, hate to recommend its use. But being the only thing that we can use, we have to take it.

Mr. Chairman: Is there anything in prospect?

Mr. Childs: Not anything that has been tested sufficiently long to draw any conclusions. I have tested out a number of the sulphur compounds. All of those have controlled scab. Soluble sulphur will burn, however. Free sulphur, as far as I know, will not cause this burning. And I think that the future development, or rather that the spray of the future in the way of sulphur will be through the use of some form of pure sulphur.

Mr. Lewis: Mr. Childs, have you seen any indication that the sulphur working on apples, either foliage or fruit, has perhaps the same effect that we begin to see on cherries and apricots where it actually stunts the fruit? The indications on sour cherries and also on apricots in California show that lime sulphur put on at a certain stage will practically retard the proper development, especially of the fruit. Fruit will never reach the normal size. I wonder whether you have seen anything in connection with that so-called sulphur shot along that line.

Mr. Childs: Well, we often call this burning sulphur shot, that is, knocking it clear off the tree. I have never seen it stop the growth of the fruit. But what we term sulphur shot with us is the absolute removal of either the leaves or the fruit. That often takes place.

Mr. Lewis: You haven't seen anything to check the ultimate size of the fruit?

Mr. Childs: No, not as far as I know—unless there is complete defoliation. If you get that combination, then the material influences the size of your fruit.

Mr. Sharp: Is the late dormant spray the most important spraying for scab?

Mr. Childs: Not necessarily. We base our control of scab—well, I won't say base it, but we look upon it as being purely insurance. That is the first spray. We put on the late spray, regardless of weather conditions. Then after that, if we are clean up to that time of the year, it is almost a sure thing that we can get through without any further application. But if we should happen to miss one of those early sprays and get an infection, then it is perhaps a fight all season and it will need perhaps two more sprays to really effect control. Our observations point out very clearly, as was demonstrated in a series of experiments, that if you start and gain headway and keep the trees protected that the chances of late infection are very slight. We insure

ourselves by putting in the first three sprays. And then if there is any gambling done, we gamble later on in the season. But to answer your question specifically, that depends on the weather conditions. Now, if it failed to rain, your late dormant spray would do no good, because there are no conditions there that would bring about infection. That is why I say we must follow a definite schedule to insure ourselves.

Mr. Sharp: Do you believe in spraying the ground around the tree with soil there?

Mr. Childs: It will do you no good.

Mr. Ritchie: We get as much rusting from lime sulphur as we do from bordeaux.

Mr. Childs: I have never seen a bit of rusting caused by the spray gun. And I think Dr. Ruth has told me that he believed it was due to the fact that an excessive amount of spray had been put on. Under our conditions we have noted no injury from the use of lime sulphur.

Mr. Garret: Do you use your lime sulphur when there is high temperature?

Mr. Childs: No, we don't use much lime sulphur after the first of June. If we do, we get absolute sulphur burn.

Mr. Garret: I have found in our work in Iowa that after you get into the higher temperatures in the summer time that burning is much more frequent with lime sulphur. In fact, our practice now is to reduce the percentage of lime sulphur as soon as the temperature goes above ninety.

Mr. Childs: Well, we can't do that with lime sulphur at all if the temperature gets over ninety. That is due probably to the fact that we get more sunshine there than you do here. I talked to Dr. Waite of the United States department of agriculture on that subject, and he said that they could use lime sulphur on the Atlantic seaboard all summer, and he attributed that fact because the intensity of the light is not so great as it is out in the far west.

Question: Would a ten horse-power engine do better work and more efficient work than three and a half or four horse-power engine on your spray machine?

Mr. Childs: I believe that very good work can be done with one gun on a three and a half or four horse-power outfit. But the

chances of doing better work favor the larger machine, because it gives you that much more latitude for carelessness. I think a very careful man can get good results with one gun on a three and a half to four horse-power outfit.

The Chairman: That depends if he can get a three hundred pound pressure.

Mr. Childs: He can get a three hundred pound pressure. I have in my paper a little summary of some work that I did this summer with reference to that.

Mr. Close: What length of hose did you use, and does the length of hose make any special difference between the difference of pressure at the pump and at the gauge?

Mr. Childs: I used five-eighths inch hose, and the pressure was reduced from 350 to about 325 pounds at the end of the 50-foot hose, a reduction of about twenty-five pounds.

Question: We want to find out here in Iowa if they have ascertained what pressure is injurious to either the fruit or the foliage.

Mr. Childs: I have used pretty nearly every kind of a pressure that I have imagined and as far as I have been able to see under our conditions, no fruit injury has occurred. We do get more lime sulphur injury on foliage where we have over-sprayed the lower parts of the trees. That is a thing I try to avoid. And I think you will help yourselves if you do not over-spray.

Question: Which is the most economical pressure to use to get the most work done?

Mr. Childs: The right pressure for the spray gun is about 300 to 350 pounds, and to maintain that without any difficulty you have to have a good rig. You had better go back to the rod if you are not going to equip yourself with machinery that is going to do that.

The work that I am spending most of my time on at present is what we call canker control in the west. It is a disease that is not present here in the east, but very similar to your canker troubles here. I am trying to work out a combination spray that we can use in the spring and give control needed in the fall. That is, the fungus does not become active until the rain starts in the fall, and the growers do not have time to spray after the fruit is harvested before infection takes place. So that in order to cut out one spray, this late spray, I am making a combination of bordeaux applied with this first oil spray that we use for scale or leaf roller or anything of that sort. That is, we apply as a spray in March, oil and bordeaux, which we hope will give a good control late in the fall.

That is still in the experimental stage, but gives promise of giving us some very good results. Along with this, we tested out a number of bordeaux combinations and other sprays. And we have found, generally speaking, that a good home-made bordeaux is very persistent. In fact, some of our chemical tests showed that from thirty to forty per cent of that copper has remained clear through a whole year on a tree, indicating remarkable persistence. This is not true of the prepared sprays that you buy on the market. They very rapidly wash from the trees. We have tested out three or four of them, but generally speaking, we have observed that they do not possess persistence like the home-made bordeaux.

DUSTING AND SPRAYING AS COMPLEMENTARY PRACTICES

W. S. Brock, University of Illinois, Urbana, Illinois

The revival time and again of the dusting question reminds us anew that "hope springs eternal in the human breast."

This paper will deal only with the so-called sulfur-arsenate-of-lead materials as applied during the growing season, or as these applications are commonly called "summer sprays." Nothing has been done at any time to show that dusting for the control of scale insects is of sufficient value or importance to warrant any discussion of the method. Up to this time also the writer has been unable to discover anything in the use of copper dust materials which would make us seriously consider these, either from the standpoint of efficiency or practicability. In these latter there is the element of cost which would overshadow the efficiency of the materials as fungicides and insecticides.

Materials

The best materials for dusting pome fruits are "superfine sulfur," or a product ground to a fineness, the grade of excellence being rated in terms of percentages which will pass through a 400 mesh sieve. Lead hydrogen arsenate of the "fluffy" type has been offered by many manufacturers. Most of these materials are satisfactory for dusting purposes. It is probably beside the point, but if sulfur could be made economically as fine as lead arsenate we would have an altogether different story to tell concerning the practice of dusting.

Machinery

Dusting machinery is quite simple, consisting of a power unit connected to a blower or enclosed fan of various sizes. For the sake of economy, both in cost and weight, most machines have been too small when used on mature apple trees. The largest machines offered have been quite satisfactory on peach trees. It should be stated in this connection that failures have generally been attributed to faulty application. This is possibly true in mature northern orchards, but is undoubtedly not true in our low headed trees in the south.

There has been established the following principles in the use of the dust method.

1. Dusting with now known materials cannot replace spraying.
2. Dusting is economical of time and, therefore, can be favorably compared with spraying as regards the total cost of the two operations.
3. The limiting factor rests in the materials and not in the manner of application.
4. Generally speaking diseases have not been satisfactorily controlled on apple.
5. Insect control has been quite satisfactory especially of such insects as the plum curculio.
6. Fairly satisfactory results have been reported in the use of nicotine dust for the control of aphids.
7. A dust mixture must consist of active ingredients.

8. The greatest promise seems to lie in the dusting of peaches for the control of curculio, brown rot or scab.

The use of figures in interpreting the relative value of dusting and spraying is not profitable as has been shown in numerous cases. Some very able men have from time to time proved by data that dusting can be used to replace spraying. A long time ago, however, it was stated by the manager of one of the large insecticide companies that regardless of the figures the man who would ultimately settle the thing would be the fruit grower. He has decided that dusting cannot replace spraying, and has not been convinced that it can even supplement spraying.

Where Can Dust be Substituted?

A great many experiments have shown that lead hydrogen arsenate exerts considerable fungicidal action; in many cases the control being as great as 75%. This has lead to a practice of using only lead arsenate and freshly slaked lump lime in water suspension on certain varieties throughout the season. The results have been quite satisfactory on such varieties as Grimes, Jonathan and others which are not susceptible to either scab or blotch. Upon varieties which will permit, therefore, dust might be used exclusively. Not much would be gained by this except in orchards where such varieties had been planted in relatively large blocks. Orchards planted with reference to cross pollination would offer very little advantage to such a substitution, since many of the other varieties would demand a more perfect fungicide. The same fact above referred to seems to establish the truth of the statement that greater fungicidal value is found in the lead arsenate than in the so-called superfine sulfur. Experiments often demonstrated that the amount of fungi on fruit sprayed with lime and lead arsenate tallied closely with that recorded on fruit dusted with sulfur-arsenate-of-lead.

Where scab or blotch are important factors spraying must be relied on. In fact, dusting has given practically no control of blotch in any experiment or when used by commercial growers. This means that with the exceptions noted it would be unwise to rely on dusting for any application prior to seven weeks after petal fall south of the fortieth parallel, where blotch would be found, and three weeks after petal fall north of that point.

Second brood codling moth, where found in only moderate numbers, can be satisfactorily controlled. Their numbers can more readily be predicted than can the amount of fungi in a given season so that a duster might well become a part of an orchardist's equipment where second brood codling moth are annually encountered and especially where a third generation of worms is the rule and not the exception. There are in nearly every season a few sections afflicted by drouths. This was true in southern Illinois this year in which many orchardists were unable to get water for either the second or third brood codling moth sprays. It was only because of an abnormally light crop of worms that there was any marketable fruit. Dusting would have been of immense value under such conditions.

The size of orchards would to a considerable extent influence the de-

gree to which dusting might supplement spraying. For example, one operating four to six hundred acres of mature trees could afford to invest in dusting equipment and materials, while a twenty acre block would certainly not warrant such expenditure. Just where the line should be drawn cannot be stated because there is still another factor, viz., the individual. Some men have the habit of "getting by" and others will always fail.

Peaches

The peach grower can, it seems, consider dusting very seriously, not only as supplementary but for all applications except the dormant. It is to be hoped that more experimental work will be done along this line. In Georgia dusting has shown up quite as well as spraying and in Illinois, while our experiments have not been exhaustive, dusting has appeared promising. On peaches hydrated lime must be used in combination with arsenate of lead and superfine sulfur to prevent burning. The writer is quite certain that the 10-10-80 dust mixture can be used for the first application after petal fall and on Elberta, or any variety of similar resistance to brown rot, probably throughout the season.

These remarks are not calculated to inspire confidence in the future of dusting apples. It is certain that in the hands of a well informed, careful orchardist dusting may have a place in all seasons, but the limitations are so narrow that it is dangerous to attempt recommendations. Therefore, it would not appear that there is any probability of an increase in dusting with present materials. Some one will eventually perfect a cheap dust fungicide which will make dusting a reality, but until that time comes "there isn't much to it."

Dusting for the control of peach pests has not received enough attention. There is essentially very little difference between self-boiled lime sulfur and superfine sulfur combined with hydrated lime. There is no difference between lead hydrogen arsenate applied either dry or wet. Therefore, since the peach tree is relatively small and can more readily be covered it follows that spraying peaches may give way considerably to dusting.

The Chairman: Professor Brock, how large an acreage would you say that a man could afford to have a dusting outfit on hand to use in an emergency just like you referred to, in addition to the liquid spray?

Mr. Brock: If you have forty acres or more, you could undoubtedly have a duster on hand and have each season enough dust materials for one application and possibly two. With a smaller acreage than that, you would need at least two power spray liquid outfits. These should be satisfactory. And the conditions which I described here now, where the water shortage was acute, would happen very seldom, I should say.

Question: In the case where you would have to use nicotine, it would be highly advisable to have a dust spray, wouldn't it?

Mr. Brock: I think so—although I haven't had enough personal experienee with nicotine dust to know what it will do.

Question: Wouldn't it be eheaper to make the ponds bigger than to get that dusting material?

Mr. Brock: Perhaps it would; they would have to be awfully big, though, if we have 130 days without rain as we had last year in some seetions.

Question: I might add here that the fruit that took the sweepstakes, the gentleman from Minnesota that has the Delicious apples, sprays entirely with a dust spray, and he is very jubilant about it.

Mr. Brock: I am going up there and find out how he does it.

The remarks that I have made concerning the dusting of apples eertainly are not calculated to give anybody definite information insofar as dusting is concerned. So far as we are concerned, there isn't anything to it, except within the limits I have already stated. In a few seasons it may be done. Those years are so seldom that it is almost placed in a elass with the frost prevention by the use of smudge-pots. We long ago decided that we couldn't afford the overhead of keeping up this sort of equipment. We have already decided in our own minds that for us the dusting is in the same eategory.

As for peaches, we are very much inelined to think that we haven't done nearly as much as we should along this line. There really isn't anything essentially different between self boiled lime sulphur and a superfine dust material. And when we add arsenate of lead to it, it doesn't make a particle of differenee whether you put it on dry or whether you put it on wet, it will do the work. Therefore, if we have materials which are prepared eorrectly I ean't see why we can't use it to control peach pests. And in a small way we have done it; only in the year when we might have gotten the best results with the use of the dust material the season has been so dry that we developed no brown rot.

Everything that we have done seems to indicate that the peach eurculio could be successfully controlled by the use of dust materials; also the faet that in large acreages it takes a lot of equipment to put the first eurculio spray on at the time it should go on makes it seem highly desirable to try to use the dust method. The faet that the trees are smaller, and that therefore the present equipment is satisfactory for applying the dust, seems to be an additional argument in favor of attempting to use dust on our peaches.

That (as I remarked in the beginning) was one of the bright things in this dusting situation. And while it is apparent that in some sections they are getting results, the fact is that we have been working for nine years and have made practically no progress—and that makes it largely a local problem. If you are getting results by all means, use it. The help problem, which is acute in some cases, will be all right, because the men who have to use it and know how to use it will not object to using the dust material. That has been our experience with it.

Question: When would you apply the first spray on peaches?

Mr. Brock: I would apply it just as soon as the petals fall, using 10-10-80 dust—ten per cent of arsenate, ten per cent of lime, eighty per cent of sulphur. Then I would wait till the shucks came off before making the second application. We are doing just that in our liquid spray, but find it pretty difficult to get them on quick enough.

Question: I would like to ask how you control the apple blotch. We are troubled with it on Northwestern Greenings on the lower limbs considerably.

Mr. Brock: You are certainly not thinking with reference to dust material at all. Blotch can be controlled by the use of either lime sulphur or bordeaux. Apply spray two, three, four and six weeks after petal fall. I prefer lime sulphur, because its damage to the fruit is less. The finish will be much better with lime sulphur, and after you have applied the blotch spray program for four consecutive years, regardless of whether you have a crop or not, you will successfully control it with lime sulphur.

Question: Is it any good when used in connection with arsenate of lead?

Mr. Brock: Yes, always, because that increases the effect. The principal thing is thoroughness of application, as Professor Childs indicated, and in which we are heartily in accord. As to the time of infection, I am sure that varies with the latitude.

Question: I am speaking of right here.

Mr. Brock: Well, I could not say, because I have not done any experimental work on this same latitude in Illinois. But I am almost sure that your maximum infection will occur about three weeks after the petals fall. That means that you must keep your fruit, foliage and twigs covered with a good fungicide from two to seven weeks after the petals fall. The curve will decrease

rapidly at a point three weeks after the petals fall, until after seven weeks after petals fall there will be practically no infection. If you have blotch and have it badly, you will not control it the first year you apply such a program.

Question: We have just a few.

Mr. Brock: Well, under those conditions the schedule which I have just given you, I believe will give you approximately 100% control the first year.

Question: Do you spray the peach at cluster bud time?

Mr. Brock: No; just after the petals fall. The old schedule, in fact our experimental station publication, doesn't call for a spray until after the shucks come off.

Question: How about cedars?

Mr. Brock: Cut down the cedars. But a good spray program will reduce the amount of infection.

Question: Can you control blotch? We have controlled blotch for two or three years on our apple trees; then the blotch would reappear. What is the latest on that point?

Mr. Brock: No, it doesn't disappear entirely, perhaps; but by preventing the formation of cankers on the newly formed twigs, we automatically cut down the amount of infection we have and therefore make it easier to control. Formerly we were told that after the blotch cankers were controlled for four years, they are no longer a source of infection. But they still continue to be a source of infection. However, we do know that after we have followed the program which I mentioned to you here a moment ago for four years, the control of the disease is relatively easy.

Mr. Sharp: Will a dormant spray of about one to five lime sulphur control blotch?

Mr. Brock: The application of no material in the dormant season will control blotch. We experimented with several orchards and after four years of very hard work grew ninety-eight and a fraction per cent free of blotch. In the first year, with the most careful program we could follow, we didn't get two per cent that were free of blotch. Under the conditions of the first three years, no one could tell whether we used lime sulphur one to four or one to eight or any other solution. This year, for the first time, we did see a pronounced smaller amount of blotch on those trees, which had the application of lime sulphur at any strength.

Mr. Sharp: You never used the bordeaux lime?

Mr. Brock: Yes, we used the bordeaux and copper sulphate, but they did not have any effect at all. They had nothing to do with the reduction in the percentage of blotch. But after we had tried to control the disease for four years, there was evidence of a slight reduction in the blotch infection from the dormant application. We checked that up, but even so, it didn't control the blotch. It amounted to some fifteen or twenty per cent, which was appreciable, but you probably would not notice it, unless you examined all of the fruits carefully.

Mr. Nichols: There is the difference in the proposition that we faced and the proposition that probably a lot of people faced. I have used dust exclusively this year, except in the dormant spray of one orchard. I will be as brief as possible. My Jonathan went ninety per cent; Grimes Golden the same; Bartlett pears the same. And I had a full crop of those three varieties. It is fair to say that they were on young trees. Now, never have I used the liquid spray without burning my pear foliage to a certain degree. There are some varieties of apples that always burn in foliage. We can't help it. There is a drip from the top of the trees when you are thoroughly spraying it all over. That is characteristic of our orchards with the liquid spray. We never burn anything with the dust.

Now as far as spraying peaches in Michigan is concerned, I will never spray my orchard again, unless things change rapidly. If I have to omit dusting, I will omit spraying. I say let them go. We are more liable to lose our peaches by spraying them with any liquid than we are by any disease we are going to get.

I also want to call your attention to an experiment. The Michigan Agricultural College dusted plums and peaches and sent them down by express to Lansing. Now you can get the bulletins on this, because I may not be exact; but on their arrival, in the ordinary course of time, both the plums and the peaches showed brown rot from those trees that were not dusted, within about a week or ten days before picking time; where dusted, they didn't show any amount of brown rot within about ten days.

Now the railroad companies, knowing that, are not going to be so willing to pay damages when brown rot shows up in transit. And in our local board meeting of the association, knowing those conditions, we notified the growers that there would be two pools this morning—those that didn't dust their peaches and those that did. Well, that was enough said. They dusted their peaches

just before picking time, about ten days. And I want to say that we didn't have a single rejection of a car of peaches shipped from our association this year; so we have no claims against the railroads.

Now this is the American Pomological Society. Its members cover a wide variety of conditions, and what is true in the district Professor Brock represents might not be practical in the district that I am in.

CORRELATION OF ORCHARD PRACTICE WITH GROWTH AND PRODUCTION

R. H. Roberts, University of Wisconsin, Madison, Wisconsin

It is common experience that use of the same cultural treatment does not give the same yields of fruit. It is also commonly noted that the most productive orchards are frequently treated quite alike. It was this condition that led to the old controversy as to whether sod or clean culture is better. More recently very contradictory results are reported as to the effect of nitrogen fertilizers upon production. The question arises then, as to how a grower may know what cultural practice is best in order to secure profitable production. In other words, has the grower any clear index that tells how to care for his orchard? We propose that he has. We believe the surest index is the tree itself —the way in which it grows.

We come to inquire, then, as to how the tree grows. For a purpose which will appear later, we will review what the plant or tree does under unusual conditions. (1) Although light is necessary for normal growth, a tree placed in shade will live for a long time. The type of growth made is very much changed however. (2) The mineral salts as nitrogen may be withheld from a tree yet it will live a long time and may make some growth, of a certain type. (3) A tree which is girdled often lives and may bear fruit for some seasons if the trunk is kept from drying out so the top can not get moisture from the soil. (4) Even a branch which has been cut off the tree and placed in water under proper conditions will make considerable growth. These things are mentioned to bring clearly to mind the fact that the tree has the necessary materials (reserves) for considerable growth *within itself.* In fact, it appears that all growth is directly related to the conditions within the plant and only indirectly related to the external environment. That is, it is necessary for an external condition to first change the internal conditions of the plant in order to bring about a change in the growth made by the plant, and consequently, its fruitfulness.

We will review, then, some of the important internal conditions, for example, in an apple tree. Chemical analyses show that the vast bulk of the dry matter in a tree is made up of the carbohydrates. These range from the simpler forms as sugar and starch through cellulose and its compounds to the more complex forms which compose the tissue and some of the reserve materials. Another significant fact is this: when there is much nitrogen present in the plant there is usually a relatively smaller amount of carbohydrates, but much protein. In other words, nitrogen largely affects the amount if not the form of the carbohydrates present in the plant. Presumably the latter are used up to furnish tissue materials for the large growth made by trees having much available nitrogen in the nutrient.

The way in which this is related to production is through the fact that carbohydrates appear to be necessary for the formation of blossom buds. If these are mostly used up by the large growth of a very vegetative tree no blossom buds result. On the other hand, if there is too

little nitrogen present for needed growth, no blosson buds are formed, although the tree is excessively high in carbohydrates. Thus, too little or too much growth is correlated with an unfruitful condition. So, a condition of balance between carbohydrates and nitrogen and likewise a balance in growth conditions is correlated with fruitfulness. This relation seems to prevail in general in orchards, trees, branches or spurs. A notable exception may be in the case of growths with a smaller diameter. Growths of average length but which are slender are usually unfruitful. Likewise, long growths (even watersprouts) which are greatly thickened up (indicating an accumulation of carbohydrate materials) frequently are very fruitful.

Other tree characters as leaf color, bark color, and wood hardness are used to indicate the general growth and fruiting condition of the trees. It must be borne in mind, however, that these growth characters do not determine fruitfulness, but are merely associated with internal conditions which result in a fruitful or unfruitful tree.

The reserve materials in the tree greatly affect the response to any cultural treatment, especially in delaying any apparent results. It frequently, if not usually, happens that the previous season's treatment of an orchard has more apparent effect upon its performance than the treatment of the current season. This is especially true of the early season development of the trees such as setting of the fruit. (Blossom buds are, of course, formed in the early part of the previous summer.) In one case under observation it was found that the reserve materials in the trees greatly affected fertilization of the blossoms. It was noted that it required from three to four days more time for the blossoms on weakly vegetative trees to become fertilized than it did for those on strongly vegetative trees. The relation of this fact to securing a crop following a cold, damp blossoming season is evident.

It also appears that the first several inches of growth are largely made from reserve materials. Thus, the amount and kind of spur growth (short growths) is often more dependent upon past treatment than upon that of the current season. This fact is especially important in connection with producing regular bearing.

We shall now consider the relation of some common cultural practices to fruitfulness, in view of the preceding discussion. Since trees which grow too much as well as trees which grow too little are both unfruitful it is evident that the same cultural practice should not be used to induce bearing of all unfruitful orchards. Trees which need invigorating will become more fruitful by the use of readily available nitrogen fertilizers. On the contrary, trees which are growing too vigorously will be made less fruitful by using the same treatment. Some orchards (especially older ones) need fertilizing; other orchards (especially younger ones) may need sod in order to get maximum results. This is certain; the treatment that is best for the 8-10 year old orchard can not be expected to give the best results in the same orchard when it is 18-20 years of age.

Sometimes even poorly vegetative trees do not respond to fertilizer treatments. Obviously no beneficial effects can be found. This does not necessarily mean that the trees in question do not need fertilizing

as is often concluded in such circumstances, but rather that some factors prevented the treatment from affecting the tree growth. One such factor is frequently that of moisture, either too little or too much. Too little moisture may limit the entrance of the salts into the tree; too much may cause poor physical conditions of the soil which have a more pronounced effect than the fertilizer additions. One case calls for better cultivation, the other for drainage.

One cultural operation which has much to do with the production of large yields of high grade fruit is that of pruning, especially as applied to older bearing trees. This is because of the need which pruning can so well fill, of keeping the wood about the top of the tree in a uniformly vegetative condition. That is, keeping it all of the type which produces the best fruit. As the responses to cutting are evident principally close to where the cut is made it is apparent that pruning to rejuvenate older run-out fruiting wood should be of a type employing the use of many small cuts instead of a few large cuts. The importance of keeping the top uniformly vegetative can be illustrated by the following fact: Observation of the growth conditions of annual bearing. Wealthy trees showed that all such trees had 20 per cent or over of their terminals (on the main and lateral branches) over 10 inches in length. If the percentage of terminals which were over 10 inches long was less than about 20 per cent the trees were biennial in habit. This varied somewhat with the density of the top, the open topped trees fruiting better than the dense topped ones. This was because of the better light conditions and consequently better opportunity for blossom buds to form (a condition associated with the accumulation of carbohydrates in the case of strongly vegetative trees.)

It is proposed that fruitfulness is correlated with growth conditions. These in turn appear to depend upon the internal conditions of the tree which are the result of the sum of external environment. It is evident that the tree conditions will vary with differences in soil, moisture, age of tree and also variety. It follows, then, that a given cultural practice which is profitable under one set of conditions should not be expected to produce the same growth and fruiting responses under another set of conditions. Practically, then, the use of fixed cultural or fertilizer treatments does not work.

We suggest instead, that the cultural treatment be based upon the way the trees grow. Note how the heavily producing trees and branches grow. Use such practices as will induce all the trees and branches to grow in this way. This method has been successfully used to give large crops of high quality fruit.

Mr. R. E. Hinds: I would like to ask one question. If one makes a mistake trying to get this particular critical result and he makes an excess application of soluble nitrate, could there be such a case in a dry year of the moisture going back from the tree to the soil and therefore wilt your tree?

Mr. Roberts: It is extremely rare that you would have to worry about that. As a matter of fact, we do not know much, if

anything, about the passage of salts from the plant back into the soil, insofar as apple trees go. It is pretty clear that there is some such passage, not necessarily limited to dry seasons. But that thing will not worry many of us. There is no general answer to give to that, that I know of.

Mr. Roberts: There is one thing particularly that you want to keep in mind: Older trees tend to load up with a mass of so-called run-out wood about the bottom. Treatment of this condition involves pruning. In a section where canker is bad, maybe you can't prune. But the point that I want to make is this: Since the vegetative condition of the tree goes along with large red apples, you want the tree to be uniformly vegetative. This means pruning to invigorate the older run-out wood about the bottom.

Question: I would like to ask if you expect a larger growth on young trees than you do on older ones. Have you tried to stimulate the older tree to make as much growth as you would on a young tree before it gets into fruiting? And another thing: About what would you expect in growth?

Mr. Roberts: A young tree generally makes more growth. The old tree generally makes much too little growth. I will cite these figures: We have been much interested, as you may know, in the biennial bearing tree. I am getting more interested in the annual bearing tree, and I find this with our Wealthy. The annual bearing tree is one which has over twenty per cent of its terminals over ten inches long. That means not only a good growth and probably a growth of eighteen inches in the main branches, but it means a *uniformly vegetative* top. If the terminal growth is less than that length the tree does not bear regularly. Regular growth does not make regular production, but is just one of the things correlated with the inside conditions in the tree, as blossom bud formation is correlated. The growth varies with varieties; but in general the so-called regular bearing varieties are those which naturally make the stronger growth. That is, with a given cultural treatment, the annual bearing trees will grow more than the others, in general.

Question: Have you any experimental work on this question?

Mr. Roberts: We have field plats in Wisconsin and also in Maryland, in co-operation with the Maryland station.

Our plats in Maryland are laid out to give conditions ranging

all the way from sod without culture and without pruning clear through to high culture combined with heavy fertilization and heavy pruning. We are measuring the fruitfulness of the trees, if we can, as we go along, by such things as the percentage of spurs that form blossom buds and the vegetative condition of the spurs that don't, so that we will know whether the tree is over or under vegetative. When we get through we hope to have something of a story, for York, as to the conditions under which it is fruitful, and at the same time, something of the cultural treatment which for that section gives the growth that we want.

Now one trouble is this, in cultural experimental work: On a soil like you have here (as I saw in Professor Maney's plats this morning near Council Bluffs), you can't hardly keep a tree from growing well, except in blue grass sod. But on a soil like some of the other locations of experimental plats, you can hardly make them grow at all well. How, then, are culture or nitrogen or cover crop tests going to answer the question of why a tree fruits, except for local purposes?

Now about sod, unless you have abundant moisture this system of culture is out of the question. We have found a combination of clover sod with commercial fertilizers to be a very successful system for growing apples where moisture is not a limiting factor.

We have demonstrated, I believe, that nitrogen is accumulated as a reserve in a tree just as definitely as are the carbohydrates. Working with trees under controlled conditions, which are poorly vegetative and over vegetative, some just bearly able to form blossom buds, others just forming them (that is, if they were more vegetative, they would not form them), we found this: At temperatures such as ordinarily prevail at the blossoming period, the blossoms of vegetative trees would become fertilized in a three to four day shorter period than do the poorer vegetative trees.

This may have an important relation to the setting of fruit in the so-called rainy seasons, where the temperatures are very low and pollen tube growth and fertilization is retarded by several days. From this viewpoint it is particularly important to have a strongly vegetative condition of the wood all over the tree.

Mr. Garret: Just one question, Professor. You spoke of maintaining the balance of the tree by pruning. I would like to ask whether there is really anything in the old story about pruning in the winter time for wood and in the summer time for fruit.

Mr. Roberts: Sometimes summer pruning works; other times it doesn't. It depends on the condition that the plant is in when you start working on it, and upon the type of pruning, etc.

Question: Would the tree growth vary in different sections of the country?

Mr. Roberts: It must, certainly.

Question: Well, then, how would you determine which way to go, what to do, if you had that growth and got results over there, and some other section of the country didn't get them?

Mr. Roberts: In general, the growth relation to fruiting is a pretty constant thing. See what kind of growth the highly producing trees are making, rather than repeat the culture that a successful grower is giving. Look at the kind of growth that the trees are making. That will tell you the story. As near as I can get at it, this is really the basis for our cultural practices—what the tree is doing. As Professor Lewis told you in his magazine some two or three months ago—"Listen when the trees talk to you."

THE EFFECT OF CERTAIN CULTURAL PRACTICES ON THE GROWTH OF APPLES

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The data set forth in this paper are intended to be suggestive rather than conclusive. They are taken from a block of Northwestern Greening apple trees now 30 years old which are growing in the Iowa State Experimental Orchard, Council Bluffs, Iowa.

The orchard in question was leased by the state in the spring of 1910 for the purpose of carrying on soil cultural experiments, the object being to vary the humus content in the soil by different systems of soil management and to measure its effect on tree growth and productiveness.

For the purpose of the experiment the orchard was laid off into six plots. The tree rows run east and west and the plots run north and south. Beginning at the east side of the orchard the plots are as follows:

1. Clover sod.
2. Clean cultivation with cover crop.
3. Clean cultivation.
4. Blue grass sod.
5. Clean cultivation with cover crop.
6. Clover sod.

The soil on which this orchard is located is known as the Missouri Loess, a supposedly wind blown formation. The physical condition is extremely uniform, sometimes to a depth of a hundred feet in this particular section.

The varieties under observation in the orchard have been Jonathan, Grimes, Northwestern Greening, Winesap and Sheriff. The Northwestern Greening has been selected for this particular report because it is the only variety which has withstood uniformly the conditions of the experiment. The other varieties were rather severely injured by the severe winter of 1917-18. During this winter practically all the Grimes trees killed out on the clean cultivated and the cover crop plots, and the Jonathan and Winesap were also severely injured. The Northwestern Greening at the time apparently was uninjured but within the last year the trees on the cultivated and cover crop plots have begun to show signs of weakness, particularly in the growth, foliage and size of fruit produced. This may be due to winter injury or it may be due to a complication of causes brought about by the cultural system.

The Council Bluffs section supposedly is on the southern limit of the extreme cold belt of the Upper Mississippi Valley. Yet whenever test winters, common to the colder regions to the north occur, fruit plantations in this region usually suffer. Especially is this true when the fall preceding has been an extremely dry one.

The behavior of the Northwestern Greening trees growing under different conditions is given in the following table:

NORTHWESTERN GREENING

Plot	No. Trees	Av. Prod. Bu. Per A. per yr. 55 trees per A.—1912-21 Bushels	Circ. Increase inches 1910-1921	Av. Twig Growth per year inches 1909-21	Av. Wt. per leaf Grams 19.5-1921
Clover	73	473.4	15.53	5.93	.79
Cover Crop	83	456.4	15.22	6.17	.76
Clean Cultivation	23	425.3	14.57	5.42	.74
Blue Grass	23	298.5	11.89	4.53	.68

The striking feature of the table is the fact that the trees on the blue grass sod have produced practically three bushels per tree per year less than those growing under the other systems of culture. The trees on both of the clover sod plots have been the high producers, and with this high production also there seems to be a correlation in growth in circumference, twig and leaf. A critical examination of the trees on the blue grass sod which have been consistently off year bearers shows that the terminal growth even where it does have the same length dimensions as that found on trees in the other plots, is invariably devoid of leaves except for a terminal whorl. The lateral leaves on this growth start with the terminal ones but early in the season the lateral leaves drop off and the buds at their base fail to develop and remain permanently blind.

In other observations it has been noted that fruit is borne on true terminal shoots, on lateral fruit spurs which arise as side growths from the buds formed in the axil of leaves on terminal growth, and also on the well known old fruit spurs scattered throughout the tree. About one-third of the fruit crop is borne on each of these types respectively. Further study has shown that the typical old fruit spurs produce fruit once in three or four years; whereas the terminal and lateral fruiting types may produce annually provided they are given a proper chance for growth development. In a way this seems to give a visible indicator as to why the trees on the blue grass sod have been low producers; viz., poor terminal growth, lack of lateral fruit spurs on two to four year old wood, and dependence on old fruit spurs which are very irregular in bearing to produce the crop. Of course it is recognized that the growth condition is dependent upon the soil condition. It may be that the blue grass sod influences the soil moisture, physical, chemical or bacteriological conditions in such a way as to withhold the amount of plant food required by the tree to produce proper growth.

Careful soil analyses have been run throughout the experiment on the different plots. It is interesting to note that very little difference has been found in the analysis of the soil on the different plots. Where such differences have occurred, just as large differences occurred in the analysis on the same plots. In other words soil analysis has not given any indication as to the difference which has taken place in growth and production of the tree.

The Northwestern Greening trees in all the plots came into the season of 1922 apparently in excellent condition. The severe "freeze out"

early in the season of 1921 completely ruined all prospects for a crop on that year and consequently the trees had a complete rest and a chance to store up food for the production of the crop of 1922. Shortly before the buds began to swell in the spring of 1922, five pounds of nitrate of soda was applied to each of six trees in the blue grass plot in order to note what affect its application would have on a set of fruit and ultimate production of these trees. Following is the average production per acre of the trees for 1922 on the different plots:

Blue Grass Sod .....688 bu. per acre
Blue Grass Sod plus 5 lbs. Nitrate of Soda applied
3 weeks before bloom.....763 bu. per acre
Clean Cultivation plus Cover Crop.....583 bu. per acre
Clean Cultivated .....525 bu. per acre
Clover Sod .....851 bu. per acre

Apparently the nitrate of soda had a very marked affect as shown by the high production of trees so treated. This increase was due largely to the very uniform set of fruit and also to the size of the fruit produced. Late in the summer it was noted that the fruit on the clean cultivated and cover crop plots was not making size as it should. This was not due to lack of moisture. It may be attributed either to the chemical and physical conditions of the soil or else to the fact that the trees in these plots were just showing up the effects of winter injury which occurred in former years from insufficient soil cover. Winter protection for the roots is an important consideration for the fruit grower of the Upper Mississippi Valley. Long years of practice and observation have shown that it is dangerous for the trees growing in this section to go through the winter without proper soil protection either in the form of a natural ground cover, artificial mulch, or a high moisture content in the soil. In general, cover crops following cultivation have not been a success in old orchards where shade is a factor. Also our late summers are not favorable for a rapid growth of young plants.

The fruit on the trees of the blue grass sod which were unfertilized was very comparable in size to the fruit on the trees in the clean cultivated and cover crop plots. To get exact records along this line the fruit was run over a Cutler Fruit Grader which is used to obtain the size records for all the plots. The following table gives the size records:

	3½″ Up %	3″–3½″ %	2½″–3″ %	2½″— %
Blue Grass	10	6	73	11
Blue Grass plus Nitrate Soda	32	47	19	2
Clean Cultivated	1	19	63	17
Cover Crop	5	44	46	5
Clover Sod	29	43	27	1

The desirable market size for the Northwestern Greening apple is three inches and above. Apples of this variety running below three inches can hardly be packed successfully in straight sizes. They require the larger apples to "sweeten" up the pack when they are put in barrels.

In packing the fruit from the different plots the poor size of the fruit from the cultivated, cover crop plots and blue grass sod, was noted. Several times the packing of the fruit on these plots had to be delayed until fruit from the clover sod plots was brought into the packing house in order to break up the uniformity of small sized apples. The similarity of fruit size in the clover sod plot and in the blue grass plot which received the nitrate of soda, seems to suggest that the available nitrates play a very large part in giving uniformity to the set of fruit and size to the fruit set. Whatever was the condition in the blue grass sod plot which had caused low production and poor size evidently was corrected by the application of a few pounds of nitrate. Of course it is recognized that the data secured are based on observations for one year and therefore are only indicative as to what might really occur over a series of years. These same results may not occur under different soil conditions from those described here, but to the grower who has trees which are non-productive there may be a suggestion of a means for changing the condition.

In practically every orchard there are conditions which tend to lower production. These are not always recognized by the grower and can only be recognized where individual tree records are kept. An illustration of this is strikingly shown in the block of the Northwestern Greening trees already described. This block of trees consists of five rows, running east and west across the orchard. Originally the trees were planted 28 feet apart and now at 30 years of age they are pretty badly crowded and sunlight is restricted to the middle rows. The south row of Northwestern Greening is planted next to a row of Sheriff apples. The Sheriff is a rather low growing tree. This fact gives the south row of Northwestern Greening an excellent sunlight exposure on the south side of the tree. As a matter of interest the production of the trees in the south row was figured and compared to the production of the third row of Greening trees from the south side which are quite badly shaded.

The following table gives the production and circumference growth record of these two rows:

Exposure	No. Trees	Av. Total Prod per tree—lbs. 1912–1920	Av. Total increase Circ. growth per tree inches 1912–1920
Sunlight	35	4,483.2	16.22
Shade	46	2,899.9	13.57

It is appreciated that in this data the factor of sunlight is not the only one involved. However, to one familiar with conditions it is apparent that it is one of the principle ones which has restricted growth and production. The remedy, of course, for such a condition goes back to the planting of the trees at wider distances.

The data obtained from soil cultural experiments in different parts of the country show a general disagreement in the results obtained

from the same system of culture. The reason for this difference perhaps is due to the fact that the trees under observation were in different conditions of growth and production when the experiment was started and consequently have responded differently. The modern fruit grower, if he is to be successful, must study carefully the conditions which exist in his own orchard. Production evidently is quite closely correlated with the type of growth which the tree is producing. In general good, strong, terminal growth, 10 to 12 inches in length, is almost necessary for approximate annual production. Where the growth is short or weak, the lateral buds on the same growth are blind and there is a preponderance of old gnarled fruit spurs, it is an indication that the system of culture or other orchard practices should be changed in order to break up an undesirable condition existing within the tree.

THE HANDLING OF APPLES IN STORAGE

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The proper storage of fruits is of vital interest, not only to the commercial fruit industry, but also to the ultimate consumer—to the man or woman who wishes apples to eat throughout the year, who wishes grapefruit through the summer months or who wishes pears at Christmas time. Statistics show that approximately 20 to 25 per cent of all apples produced in the United States move into artificial cold storage, while even a higher percentage are held for varying lengths of time in common storages, farm cellars, etc. It is not an exaggeration to say that the quality of any fruit when it is finally eaten will depend in greater measure upon when it is picked and how it is handled from picking time on until it is consumed than upon any factors of orchard management that precede picking.

In order to gain a comprehensive grasp of fruit storage it is essential that the history of the fruit development be considered before picking, as well as following removal from the tree. The life history of an apple is continuous from the inception of the flower parts in the bud until consumption or decay of the fruit marks the end. In this history picking marks a milestone second only to the setting of the fruit in importance, for it marks the end of certain processes, and the beginning of others that result in the ultimate breakdown of the fruit. The time of picking exerts a great influence upon the later history of the fruit.

As the fruit approaches maturity on the tree there are certain well defined developments. There is a marked increase in sugars and total carbohydrate and a gradual decrease in the acid content of the fruit. There is also a gradual softening of the fruit, probably due to the calcium pectate, which cements the cells together in the green fruit, changing to soluble pectin materials, and thus allowing the cells to break apart readily. As the fruit approaches maturity there is one other highly important change that occurs. The skin becomes suberized, or waxed over, becoming less permeable to water and gases. The lenticels become corked over. These changes are associated to a certain extent with color development, for the blushed side of fruit shows a thicker and less permeable skin than does the unblushed side, while highly colored apples show a more highly suberized skin than do poorly colored fruits. As the red and yellow pigments develop there is a corresponding decrease in green chlorophyll. The principal changes occurring in the fruit before it is picked, then, may be summarized as follows: (1) Increasing carbohydrate content, most of which is sugar; (2) decreasing acidity; (3) pectin changes, leading to a softening of the fruit; (4) skin changes, leading to a covering that is more impervious to water loss. With these are, of course, associated a continuing increase in size unless picking is delayed until very late.

When the fruit is separated from the tree, certain of these changes stop, and certain others continue. There is, of course, no further increase in size, after picking. The color also remains constant so far as the amount of red is concerned, though the green progressively

changes to yellow. We do not know whether or not any further skin suberization occurs after the apple is removed from the tree, although it seems probable that there is a change in the skin during the first few days after the fruit is picked, during the time that apples go through the "sweat" immediately after picking.

The total carbohydrate supply, including starch, sugars, pectin materials, etc., is at its highest at picking time. After picking the starch changes to sugar fairly quickly, so that there is a pronounced initial increase in sugar content. This change is completed within a few weeks, even in fruit held in cold storage. After that time there is probably a small amount of sugar added to the fruit by the hydrolysis of pectin material, and a small amount consumed by respiratory processes, so that the total change in amount of sugar is practically negligible.

The pectin change, with the associated softening of the fruit, proceeds even more rapidly following picking than while the fruit is on the tree, provided it is held at the same temperature. Likewise, the loss in acidity proceeds more rapidly following picking than while the fruit is on the tree. Fruit picked and held in the orchard or in the packing houses at orchard temperature softens much more rapidly and ripens more quickly than similar fruit remaining on the tree.

Time of Picking

From the foregoing discussion of the changes associated with ripening it is apparent that the time of picking is of tremendous importance in fruit for storage. Fruit picked too soon is of smaller size, poorer color, lower in sugar content, and because of lack of suberization of the skin, prone to wilt in storage. Fruit picked too green also has a tendency to develop storage scald, the name applied to the browning and blackening of the skin of apples while in storage or upon withdrawal from storage.

On the other hand, it is easily possible to leave the fruit on the trees too long for best storage holding. The fruit may become soft on the tree, or become infected with fungus diseases that earlier picking would have avoided. What is more likely to happen is excessive loss from dropping.

Most varieties of apples may safely be picked when the ground color changes from green to a light yellowish green. This is a fairly reliable test for most of the red or blushed varieties. There is considerable variation in color in various varieties, however, so along with the ground color must be considered ease of picking, high or red color, softness of the fruit, etc. It is an entirely safe assumption to say that a far greater percentage of apples is picked too green for best storage fruit than is allowed to become too ripe.

Care in Handling

It is unnecessary in discussing storage before the American Pomological Society to emphasize care in handling during the picking, packing, and storing operations. Suffice to say that only fruit with intact skins should be stored, for it is impossible under any storage condition that

will not freeze the fruit to prevent growth of rots and molds if unsound fruit is placed in the storage rooms.

Let us now consider the actual storing of the fruit and see what influences the factors that it is possible to control in storage rooms, namely, temperature, humidity, and ventilation, have upon the keeping quality and the dessert quality of the fruit.

Temperature of Storage

First let us consider temperature, for it is by far the most important element in proper handling of fruit. The lower the temperature, the more slowly all the changes associated with ripening of the fruit occur. Softening takes place very slowly under low temperatures and the acidity decrease is very gradual. Mechanical tests of the rate of softening of the fruit have shown that such varieties as Jonathan, Delicious and Rome Beauty will actually soften more in two weeks at 60° F. than they will in four months at 30 to 32° F. Such varieties cannot be handled from the tree to cold storage too quickly, and common storage or cellars can be employed successfully only if the fruit is to be held short periods. Such varieties as Winesap, York Imperial, Ben Davis and Yellow Newtown soften somewhat more slowly, regardless of temperature, than do the early winter varieties, but even with these varieties a month at 50 to 60° will soften the fruit more than five or six months at 30°.

Not only does fruit soften more rapidly and retain its acidity better at low temperature, but it is also far less susceptible to fungus attack, because of the exceedingly slow rate of growth of most fungi at 30 to 32° F.

To summarize, the effect of temperature on apples in storage then, it may be said that the lower the temperature, down to 30° F., the harder and juicier the fruit will be when removed from storage, also the more spritely it will be because of higher acidity, and the less loss there will be from storage decay. In this connection the great importance of moving the fruit to storage quickly can not be over emphasized. It is not an exaggeration to say that 75 per cent of the Delicious apples grown in the northwest are really past their prime when they are ultimately consumed in the eastern markets, because of delay in getting the fruit chilled down, high temperatures in transit, and delay in eastern fruit stands.

Humidity of Storage

The amount of moisture in the air which results in best storage conditions for apples will vary greatly with the type of container in which the fruit is stored. A storage for barrels may be fairly dry, as the atmosphere inside the barrel is rather moist in any event, due to the fact that moisture given off by the fruit escapes from the barrel very slowly. On the other hand, for fruit stored in crates, open hampers or baskets, it is necessary that the storage air be kept fairly moist to prevent wilting and shrivelling. Cellars and common storages are par-

ticularly likely to become too dry unless moisture is added during the cold winter season and during times of heavy ventilation.

The principal influence of storage moisture is in preventing shrivelling, with a resulting crisper and better appearing fruit. It has no direct effect on the rate of softening, on acidity change, or on flavor or aroma. There is strong evidence that low humidity decreases scald, but it does so at the expense of a bright, turgid fruit. Under too high humidity conditions mold growth will develop on the fruit. The best humidity for apple storage is around 85% saturated, with permissible variation being below this for barrels and slightly above for open containers.

Influence of Ventilation on Apple Storage

The role of ventilation in apple storage has been widely discussed, and great claims have been made concerning the value of ventilation in preserving the flavor of fruit in storage. For that reason it is particularly important that the question be considered carefully.

It is important to distinguish between ventilation for the sake of cooling, as we use it in common and cellar storage houses, and ventilation for the sake of air renewal, as has been recommended for cold storages. In the former case, large volumes of air must be used, since a very great quantity of air must be used to cool a relatively small quantity of fruit. Let us assume, for example, that air at 40° was passing over a barrel of apples and leaving at 50°. Considering the fruit at 60° to begin with, over 6,000 cubic feet of air would be required to cool the fruit to 50°. This represents a volume of air of over 1,000 times the volume of the fruit package. These figures emphasize the absolute necessity of large ventilation openings and provisions for air circulation about the fruit in cellars and common storage where cold outside air is depended upon to cool the fruit. Briefly, the air inlet openings for such a storage should total not less than 1% of the total area of the floor space and preferably considerably more, with outlet openings through the ceiling of about half the area. It should be remembered, however, that this recommendation is to secure temperature, rather than ventilation as such.

As for ventilation of cold storages, where temperature control is secured by refrigeration equipment, much has been claimed, but little established. It has been claimed that such ventilation will greatly improve the quality and appearance of fruit at the end of the storage term, and the fruit held under ventilation will be of the same high quality when removed from storage that it was upon going into the storage rooms. Carefully conducted tests have shown, however, that there is no improvement in aroma, or flavor of fruit held under ventilation. The acidity decrease is as rapid, and the fruit softens as fast under continuous ventilation as under non-ventilated conditions. In so far as ventilation is associated with drying and wilting of the fruit, it will apparently be of some help in controlling scald, though the efficacy of ventilation control of scald in apples stored in barrels or wrapped boxes in commercial cold storage is extremely doubtful. Air

circulation within the rooms to avoid pockets and give a uniform temperature is highly desirable, but the value of passing outside air continuously into cold storage rooms has never been established.

The Aroma of Fruit

Equally important with flavor in making up quality is the aroma of the fruit. It is exceedingly important that the aroma be preserved to the greatest possible degree in the storage of fruits.

Apparently aroma in fruit is developed in greatest degree only at relatively high temperatures. If a room is filled with apples and held at 60° or thereabouts, the odor is very strong. It is a well established fact that fruits held in common storage ripen with a much more marked aroma than fruit held in cold storage for a long period.

While it is impossible to measure aroma chemically, careful observations have been made upon the effect of various storage conditions on its development. Temperature of 60 to 70° F. are essential to highest aroma development, and fruit well ripened on the tree, held at 60° until soft ripe, will develop the strongest possible aroma. Immature fruit develops far less aroma than similar fruit left on the trees until well ripened.

Fruit held in cold storage gradually loses not only its aroma but the possibility of its developing aroma when removed from storage For example, Winesap apples held two months at 30 to 32° and then removed to 60° will develop almost as high odor as if never placed in storage. After four months the aroma is less pronounced. After six and eight months fruit taken from cold storage shows still less aroma. The highest aroma in any variety may be secured, however, by holding the fruit in storage at a low temperature, then by removing it from cold storage and allowing it to soften at temperatures of 60 to 70°.

To summarize, then, the factors that govern the successful holding of apples in storage, we must first of all emphasize picking at the right time and handling in the right way before the fruit moves into storage. Long keeping, high flavor and high aroma can never be attained in immature fruit. Then we must emphasize low temperature as the one vital necessity for successful holding. A continuous temperature of 30 to 32° in cold storage and the nearest approach it is possible for the cellar or common storage man to make to this tells the story of successful apple holding. The rate of cooling in common storage will depend upon outside temperatures and upon ventilation, and upon the rate of cooling will depend success or failure in fruit storage.

Humidity control is important, particularly when fruit in common storage is being ventilated heavily, and may be secured by sprinkling, water sprays, etc. Humidity control will prevent wilting, but temperature control, through its influence on the fundamental life processes in the fruit, determines more than all other factors combined the storage life of the fruit.

Mr. R. E. Hinds: Will fruit freeze more quickly in the boxes off the tree than on the tree?

Mr. Magness: If you have your fruit in boxes, if it is a question of frost protection during the time when you are in danger of freezing, you will get freezing a little more quickly on the tree than off. Your fruit in the box, a fairly large body, won't freeze as quickly through the box as your single apples will freeze on the tree. It takes a fairly heavy freeze, however, to really seriously damage the fruit on the tree. A pretty heavy frost usually won't do any harm. But, of course, if it is getting late enough so that you are liable to run into a real freeze, you'd better get it off and under a shed.

Mr. F. O. Harrington: If the apples on the tree freeze entirely so that your core is frozen, it will always turn black and it injures the fruit in that case.

Mr. Magness: Yes, if it freezes and you get temperatures lower than twenty-six degrees. It takes about twenty-six degrees to do any particular injury.

The Chairman: How long?

Mr. Magness: Fruit will stand about twenty-six degrees up to twenty-four hours without appreciable injury. But if you go below that you are going to get solid freezing through and through.

I might say in that connection that a great many fruit handlers have the idea that fruit will freeze at thirty-two or a little below thirty-two. As a matter of fact, it takes from twenty-six to twenty-seven degrees to freeze apples, due to the fact that an apple isn't just water. It is water imbedded in the flesh of the apple and with a lot of sugar, etc., in it, and you won't get freezing in apples until you get down to about twenty-six degrees. Some other fruits will freeze at somewhat higher temperatures than that.

Question: Even if your apples are frozen solid and thaw very gradually, you will not find injury in that case, would you?

Mr. Magness: It will depend on the degree of freezing. I might say this (it is getting into a rather technical discussion): The amount of freezing that you get will depend on the temperature, because as the fruit freezes it draws the water out of the cells and there are certain air spaces in between the cells, and that is really where the ice formation takes place. Well, now, if you have a temperature of, say, just twenty-six, there will be just a very slight ice formation taking place there. If you have a temperature of twenty-four there will be a little more ice formation.

And if you get twenty-two there will be still more iee formation. So that it depends on the amount of ice formation. If you get a freeze down to twenty degrees it is going to do damage, regardless of how slowly it thaws, I think. But it is simply a question of how hard the fruit is frozen, how long it has been exposed to the temperatures, and how low the temperatures are that it has been exposed to.

Mr. F. O. Harrington: Do you think the slowness of thawing out makes no difference as to the result following the freeze?

Mr. Magness: That is a question that has been very much discussed and very mueh disputed. Some people who have investigated it have said that it makes no difference. Others have claimed that it does make a real difference. I think the safe thing to do is, if you know your fruit is frozen, thaw it as slowly as you can. That is the safe thing.

Now I wouldn't want to be quoted as saying that it does make very much of a difference; but as long as there is a difference of opinion we had better play safe. As I say, there have been some people who have made careful studies and they have said that it did make a difference, and some have said that it does not. So until it is definitely known one way or the other, the safe thing for the grower is to thaw slowly if possible.

Question: Aren't there some varieties that freeze more quickly?

Mr. Magness: There is a slight varietal difference. Some varieties will freeze just a little bit more quickly than others, and, of course, some will go to pieces much more quickly than others will. I have had this experience, for instance, with Bartlett pears: I have seen Bartlett pears that were frozen pretty hard while they were still green, frozen in storage, taken out and ripened, and if you didn't know they were frozen you could never detect it. The same thing is true with apples if they are not frozen too hard. But if they are frozen too hard practically any variety will go to pieces and blacken.

Question: In storing down in Missouri we pick our Jonathan and Grimes Golden apples sometimes at ninety-five and ninety-six degrees during the day. Those apples are hot. Now then, we may be delayed a day or two in getting a refrigerator car. I noticed this year especially that many of the Illinois growers advertise pre-cooled apples. Now could you give us some light on that? Is there an advantage to pre-cool those apples right away, enough to justify the extra expense in the orchard?

Mr. Magness: There are a lot of economic questions that come in there as to whether a man can afford a pre-cooling plant or not. Certainly, the individual grower cannot do it. If you have a sufficient amount of stuff to move and you are moving, particularly, a lot of varieties like Jonathan and Grimes and Wealthy, and you do have difficulty in getting them immediately into cars, it is, of course, a tremendous asset to be able to move them into cold storage or into some kind of cooled storage. However, a pre-cooling plant for apples, unless you have need for the storage throughout the year, is rather a questionable undertaking, because your overhead is very high—that is, expensive equipment and the building costs are very high. But if you have a sufficient amount of fruit to store that you can maintain a storage plant throughout the year, it is a different question. I would say, however, unless you do have need for a storage plant and can fill a reasonably sized storage for winter holding, that it is questionable whether you can afford a pre-cooling plant for apples. You simply have to take your chances under those conditions.

Temperature, low temperature, is the one thing that will slow down all of these ripening processes in the apple. It will retard the softening. It will prevent the loss of acidity and juiciness. It will keep the fruit sprightly. It is the one thing that will slow down the ripening processes of the fruit without greatly injuring the flavor and the appearance of the fruit. For that reason, I say that 95 per cent of the success in apple storage is a question of the temperatures that you can maintain. And it doesn't make any difference whether those temperatures are maintained by artificial refrigeration or whether they are maintained by an air-cooled storage or what not. The length of time that your fruit is going to hold is going to depend practically entirely upon the temperatures that you can maintain in your storage house. And if you can get thirty-two degrees, thirty to thirty-two degrees, the fruit is going to hold just that much longer than if you get thirty-five degrees; and if you get thirty-five degrees it is going to hold just that much longer than if you get forty degrees or fifty degrees or sixty degrees.

The experimental work on fruit storage, backed by all commercial experience, has shown that around thirty to thirty-two degrees is a safe temperature for storage and is the temperature which will preserve the fruit in the best manner.

In moving the fruit into storage, of course, it is very important

that it move in quickly. Most of you have probably seen the little exhibit of the Iowa State College over at the exposition, showing the influence of delaying storage of Grimes apples week by week. There are a number of boxes picked on the same day, some of which went into cold storage immediately, some delayed one week, some two weeks, and so on. Apples that were delayed two weeks are now dead ripe; and those apples that were moved at once into cold storage are not yet ripe enough for eating.

Aside from its influence on the fruit itself in keeping the fruit hard and maintaining the flavor, low temperatures have another very important factor in keeping away decay in the fruit to a very large extent. Rots in fruit are practically all caused by fungus organisms, which grow very slowly at cold storage temperatures. Most of them, however will grow even at the lowest temperatures it is possible to maintain in storage without freezing the fruit. And if it is stored down to thirty degrees, if you have rot specks in the fruit or broken skins in the fruit where rots can start, you will get a certain amount of decay. But the growth of these diseases, we can say, is less than one-tenth as fast in cold storage than it is at higher temperatures. So that is a real factor in preserving the fruit in cold storage.

Now, there are some other things which we can control in storage and which are quite important, very important under certain conditions. One of these is humidity. This is particularly important in common storage. It is less so in cold storage, particularly if the fruit is being stored in barrels. Fruit stored in barrels is in such a tight package that there is going to be very little wilting of the fruit in any event, even if the storage rooms are very dry; also, it doesn't make so much difference because the fruit inside the barrel is almost under constant moisture conditions, regardless of what the moisture in the air outside of the barrel may be. But if the fruit is being stored in bushel baskets or in ventilated crates or in open boxes, it is important that the humidity be kept fairly high. And this is particularly true in common storage, where a lot of air movement must be maintained in order to keep the fruit cooled out.

Under those conditions it is necessary that the floors be sprinkled down or that some provision be made for keeping up the moisture supply in the rooms. There is little danger of getting too much moisture, so long as you are ventilating and getting air movement. At the time, however, that the outside temperatures

become so cold that it is necessary to close up the building and keep it pretty tight, it is also time to cut down a little bit on the sprinkling, in order that you won't get mold growth on the fruit.

For the maintaining of proper humidity it is necessary to take readings with apparatus which the weather bureau has used. That is, the so-called sling-psychrometer. However, for most growers the humidity can be maintained fairly well by watching the condition of the fruit; if there is any evidence of wilting keep the floor sprinkled down, and if there is any evidence of mold growth on the boxes or on the surface of the fruit stop your sprinkling and air out your houses, ventilating them thoroughly, which will tend to dry off the surface.

The function of humidity is entirely to prevent wilting of the fruit. Even if the fruit is not picked until it is in the right condition and if it is exposed to continuous movement of dry air, you will get rather excessive wilting; and this can be handled only by taking some means of adding moisture to the air.

The question of ventilation in apple storage is the thing that we want to discuss quite freely, because it is a question that is very much alive at the present time. Exactly what will ventilation do and what it will not do in both cold and common storage? And in order to discuss this we must separate ventilation in common storage, where we are using the air for cooling, from ventilation in cold storage, where the cooling is secured by other means and where the value of ventilation, if any, is in maintaining the condition of the fruit.

First, in common storage or in the air-cooled type of storages, cellars and above ground common storages, it is absolutely essential that the air be moved through the storage in large volumes in order to effect the cooling of the fruit.

You are all familiar with the principle of these houses where the houses are opened up whenever the outside temperature conditions are such that the fruit will be cooled. In other words, whenever the outside air is cooler than the air inside the house, the vents are opened up and an air movement is maintained through the fruit until such time as the outside temperature gets higher than that inside the cellar or storage house; then the vents are closed until the outside temperature gets low again. In other words, whenever it is cool outside, everything is opened up and the air moves through for the purpose of cooling the fruit.

Now a mistake that has been made in a lot of houses that are

constructed on this principle is that the vents have not been large enough to allow as much air movement through the houses as is essential for the most rapid cooling of the fruit. Air will warm or cool very quickly, and if the heat is to be carried out of the fruit it can only be done by a great volume of air moving through.

We figured what the theoretical quantity of air would be that would be required to cool one barrel of apples down ten degrees. We assumed that the air was coming in at forty and the fruit was at sixty when the air struck it. It is a surprising figure. To cool a single barrel of apples, using forty degree air and cooling that barrel down ten degrees and the air leaving at fifty degrees would require six thousand cubic feet of air. In other words, six thousand cubic feet would be storage space for more than one thousand barrels of apples; and yet that volume of air would have to move over the barrel in order to cool it down. That seems like an almost impossible figure. But, of course, that air movement is fairly rapid and if your vents are of good size it doesn't take very long for that amount of air to move through a building. In other words, the volume of air that moves through must be about one thousand times the volume of the fruit; or it will take one thousand air changes in a cellar to cool the fruit down.

Question: Has it been demonstrated that wrapping with oil paper prevents scalding?

Mr. Magness: That has been fairly definitely demonstrated, provided the paper carries a sufficiently high percentage of oil. In the first recommendations that were made of oil paper, unfortunately, the amount of oil that was required was not specified, and a great deal of commercial paper was put out carrying oil up to four or five per cent by weight. That small an amount of oil will not control scald. However, it has been found that if the paper contains up to fifteen per cent by weight of oil that it is very efficient in the control of scald; not absolutely one hundred per cent, but pretty close to it.

The Chairman: What are the recommendations that the department is giving on that subject now—on scald and on the wrapping?

Mr. Magness: The recommendations are to wrap in oil paper carrying fifteen per cent oil.

Mr. Chairman: Are you really advising the growers to do that?

Mr. Magness: Yes, that is being advised and is being done.

It is really, we might say, in the status of a commercial trial at the present time. There are quite a few of the western boxed apples this year that have been wrapped in paper carrying fifteen per cent oil. Last year there were a large number of western apples wrapped in paper carrying smaller amounts of oil, and the scald control was not good. In fact, while it was perhaps a slight improvement over the ordinary paper, it was not sufficient to give conclusive results. So that it is important in scald control that the paper carry at least fifteen per cent oil.

Mr. R. E. Hinds: Is that a mineral oil?

Mr. Magness: That is a neutral mineral oil, yes. That paper is being made at the present time by a number of paper companies, and most any of the oil paper they are putting out is all right, so far as the oil that is used is concerned. Practically any mineral oil is satisfactory. The particular precaution is to get a definite statement of the amount of oil that the paper carries.

Question: In the matter of paper, gentlemen, we had charge of the Missouri Fruit Exhibit at California. My business was to go down to the cold storage every week and examine the fruit. Our Missouri fruit was wrapped in oil paper and also with tissue paper. We found that the York Imperial and the Mammoth Black Twig were scalded so badly that we could not put any of those two varieties on the table during the exposition at the Panama Exposition. Now this gentleman speaks here of ventilation. Did I understand him to say that if they should have been put in baskets that were open, that it would have carried better than in barrels?

Mr. Magness: It would have carried better, so far as scald is concerned.

Question: But that was our experience at the cold storage in San Francisco, that we just simply lost out entirely on the York Imperial and on the Mammoth Black Twig. The other apples all passed the scalding trouble, and we didn't have any trouble with them.

Mr. Magness: I might say in that connection that York Imperial is one of the very worst varieties for scalding, and absolutely the limiting factor in the time that York Imperials can be held in storage is scald. For that reason, where York Imperials are an important commercial variety (which is particularly true

in Pennsylvania and in the Virginias) they figure on moving them out of storage by the first of March; whereas, except for scald, they would hold in good condition for a couple of months longer.

Question: Is it to be recommended with susceptible varieties in barrels that you would chop staves or bore holes in those barrels to give them better ventilation?

Mr. Magness: That is a thing that has been recommended. As a matter of fact, it will probably help a little bit; but it won't effect control. The openings that it is possible to make without weakening the barrel are hardly sufficient to give really satisfactory ventilation.

Apparently the influence from ventilation from the studies that we have made is this: that it is really a drying action rather than a ventilation action. Low humidity will be advantageous in preventing scald. But if you run your humidity low to prevent scald, if you control your scald by low humidity, you are going to get excessive wilting. And that is the practical difficulty of using that method in scald control. In other words, of the two evils, excessive wilting is just as bad as a certain amount of scald.

Question: Have you got any figures of where it ceases to be profitable to operate your cold storage? We have a cold storage filled, say, this time of the year, and we get to fifty per cent of the capacity. Have you studied that phase at all?

Mr. Magness: That is purely an economic question, which we can't give any off-hand answer to, for this reason: It would depend on the size of your storage, and any man who is operating a storage and knows his storage costs, his operation costs, should be able to answer that question. But it will depend so much on questions of size of storage and power cost and that sort of thing, that it wouldn't be possible to make any general answer.

Question: That is a very important thing for a farmers' organization. Of course, you can get the figures of the big city cold storage plants.

Mr. Magness: I might say in that connection that the figures of city cold storage plants are a questionable application to farmers' organizations, for this reason: The American Warehousemen's Association a few years ago investigated this question, as

to what was the smallest profitable unit of cold storage. Basing it on city conditions, they came to the conclusion that anything less than one million cubic feet was not feasible.

Well, we know that there are many cold storages being operated through the country by farmers' organizations and by individuals in the country where the land costs and overhead are not so high, where they are storing well down to fifty thousand barrels, which would not be a fifth of the capacity that the Warehousemen's Association say is the smallest feasible amount, and yet which are paying very good dividends on their investment. I know personally of one box storage which stores only about 120,000 boxes a year, which would be the equivalent of 40,000 barrels, which has been paying very big dividends. Their construction costs are not high and their operating costs are not high. So that it depends so much on local conditions, that we can't make general answers.

Mr. Gould: Would the selling price of the fruit also be a factor, so that the cost in the storage house, whether it was fifty per cent or full, might vary from season to season, depending on the selling price for food?

Mr. Magness: I think the way you would have to get at that question is this: If you have a farmers' organization and you know what your total amount of fruit is going to be, and if you were going to put that fruit into cold storage and hire your storage if you didn't own it yourself, you could easily determine whether you could afford to run your plant for ten thousand barrels or whether you ought to pay storage on ten thousand barrels in somebody else's plant. That would really be a point that would have to be decided.

Question: This is a mighty important question. We have certain growers who have a production of 40,000 barrels a year. We are not so situated that we can sell any other items. As a matter of fact, it is a question of whether or not it pays to operate on apples alone or to cut down the overhead. Now I don't suppose there is any single question in regard to storage that is as important as this one. Will it pay me or will it not, when I have the production, to build a storage or have one built for a group of men that can only be operated for the storing of apples and no other products?

Mr. Magness: I might say in regard to that, that there are a number of storages of about that unit that have been successful.

If you have good storage facilities available, whereby you can move your fruit quickly into cold storage and pay the storage charges, apparently from what study we have made of that, around fifty to sixty thousand barrels is about the minimum unit that it would pay to construct rather than to hire storage space. However, one very vital question there is whether or not your storage is available and as quickly available at the time you want it. That is, if you have to ship for several hundred miles or for quite a distance, it is a difficult proposition. It is always an advantage to have your storage where you can move the fruit in quickly. And I would say that roughly around 50,000 barrels is about the figure that you can use as a minimum to carry the overhead expenses of your storage plant and your management.

Question: There is another question that we have come up against very often, and that is to what degree is the keeping quality of fruit interfered with by holding in a period of cold storage? That is, for example, on sales made January or February, where the stuff had been in cold storage for a couple of months, would it have been worse if it hadn't been put in cold storage at all?

Mr. Magness: That question will depend entirely on the condition of the fruit. The fact that it has been in cold storage in itself usually will not hasten its breaking down. However, we must remember this: that the fruit is always ripening a little bit in cold storage. We can't absolutely check those ripening processes at any temperature above freezing. If the fruit is in fairly good condition when it goes into storage and then has been in storage for a number of months, during that time the fruit is gradually going down, it is gradually getting riper and getting softer, and when it comes out of storage the number of days that it will hold up is going to be decreased in proportion to the time it has been in storage; not because of the fact that it has been exposed to low temperatures, but because of the fact that it is riper when it comes out than it was when it went in. I think that is the whole question there. We have never been able to see that the actual cooling of the fruit or chilling of the fruit had any particular influence on causing breakdown after it came out of storage.

Question: We often thought with fruits like cherries that there was no effect there, possibly on short distances, where it was better without refrigeration than with refrigeration and then taking it out. It is merely a supposition. We haven't any data on it.

Mr. Magness: Here is one thing you would have to bear in mind on that: In shipping short distances, if you ship under ice, your fruit is going to be pretty nearly at the destination before it is cooled out anyway, and it is undergoing very rapid ripening during that time. The ripening processes are not delayed until the fruit itself is cooled; and it takes quite a long time for a box of fruit to cool out, even when the air surrounding the box is chilled. Even with such a thing as sweet cherries, ten pound flats as the western shippers use, small boxes with the fruit packed in about two inches deep, they will require about ten hours to cool out when put in a cold storage plant. That means, if it is a question of a twenty-four hour shipment in a car and the fruit is piled in solid masses (it has got to be to prevent shiftng), the fruit inside those packages hasn't cooled a great lot, even by the time it reaches destination. And I think that you would find in that your explanation, rather than in the fact that the actual cooling had resulted in more rapid deterioration.

Question: Have you any data on the comparison of storage between the western fruit and the middle-west and the north? Has there been any data kept on that—whether there is a difference in the keeping qualities in storing between western fruits and our middle-west fruit?

Mr. Magness: That is more largely a question of varieties than anything else. For instance, the western Winesap or the western Yellow Newtown will hold up in storage remarkably well. On the other hand, some of the eastern varieties will hold up just as well. It is more a question of the temperatures that are maintained than the variety. Certain varieties, of course, are short storing apples and certain other varieties are long storing. It is true that on certain fruits there is an influence in the climatic conditions. We have found in the case of the Bartlett pear, for example, that the pears need very warm growing conditions to give the longest keeping quality after picking. That seems like a peculiar statement; but it is true that the pears from the hottest district, for instance of California, the pears that are grown right out practically on the desserts will hold up better after picking than pears that are grown under more cool and humid climatic conditions.

Question: That was my question in regard to the apple proposition.

Mr. Magness: In regard to the apples, we haven't noticed any outstanding variation; and due to the fact that the apples are so different, it would be hard to say. For instance, we can't compare a New York Baldwin with a Hood River Yellow Newtown in keeping quality, any more than we could compare a Jonathan. But apparently the main problem in apples is to get them cooled promptly.

I might say this: that this year, for example, the western Jonathan and Delicious shippers have been up against a problem along these very lines that is rather discouraging. In some of those districts they have a car shortage right at the height of their Jonathan and Delicious shipping season. The fruits sat around the packing houses until it was practically dead ripe before it went into the car. That fruit is arriving on the market, of course, in fully ripe condition and not suitable for storing. They had figured on loading most of those two varieties into ice cars and shipping at once. They have had their troubles there as well as some sections in the east on the car situation.

Question: Will heavy fertilizing of apples cause premature breaking down in storage of apples from those trees?

Mr. Magness: Apparently it will, if the nitrogen fertilizer is put on sufficiently heavy, so that you get over-sized and poorly colored fruit. Very large fruit has never as good keeping quality as medium-sized, more compact fruit; and also highly colored fruit is practically always better storing fruit than green colored fruit. So that if you put on sufficient nitrogen, that you get very large size and have sufficient foliage that you don't get color development in your fruit, it won't be as good fruit as though you had applied nitrogen and not put on so much.

Question: It depends, then, on the size at maturity?

Mr. Magness: Yes. But, on the other hand, there are certain cases where application of nitrogen will improve the storage of the fruit. By moderate applications in conditions where the fruit is of very small size and tending to pit badly, you will get really a better storing fruit. In other words, it comes back to the condition of your tree. A tree of moderate vigor producing a moderate sized fruit will give the best fruit for storage.

ADVERTISING AS A FACTOR IN THE DEVELOPMENT OF AMERICAN HORTICULTURE

C. I. Lewis, Managing Editor, American Fruit Grower Magazine, Chicago, Ill.

Advertising as a business practice is centuries old, but during the past fifteen years there has been a remarkable development. As yet, advertising has not reached the point where we can say the last word has been said. Advertising pays. If it did not the biggest business concerns in the country would cease to advertise. Advertising is salesmanship and good salesmanship means advertising.

There are many evidences that advertising pays. You can subject yourself to two or three simple tests, which will prove conclusively that advertising has had a marked influence on you. Recently I wrote down on a piece of paper the names of best known products that I could think of and when I had completed my list, this is what I found I had written down:

If you think of soap, you say Ivory; soup, Campbells; pickles, Heinz; oranges, Sunkist; raisins, Sunmaid; canned goods, Del Monte; beverages, Coca Cola; coffee substitute, Postum; gelatine, Jello; loganberry juice, Phez; walnuts, Blue Diamond; dried peaches, Blue Ribbon; cheese, Kraft; condensed milk, Carnation; watches, Elgin; oil heater, Perfection; paraffine, Parowax; aluminum, Wear Ever; safety razor, Gillette.

Then I began to think of slogans which are used in connection with advertising. In two or three minutes I found I could write sheets of these slogans. Here are a few which you could write just as easily as I did:

Grapenuts—"There's a reason."
Paint and varnish—"Save the surface and you save all."
Royal typewriters—"Compare the work."
Sunkist oranges—"Uniformly good."
Blue Diamond walnuts—"The crackin' good."
Ivory soap—"It floats and 99.44% pure."
Mistland prunes—"Tartsweet."
H. C. McCann—"The truth well told."
The new Edison—"The phonograph with a soul."
Packers Tar Soap—"Pure as the Pines."
Nonesuch Mincemeat—"Like mother used to make."
Bon Ami—"Hasn't scratched yet."
Victrola—"His master's voice."
Skookum apples—"Every bite a delight."
Paul's Jams—"From the Valley of the Mountain."
Automobile—"The good Maxwell."

Likewise, I am quite sure you are familiar with official designs which are connected with advertising. Here are some which are very common:

Skookum—Is the Indian head.
Deerfield oranges and grapefruit—the stamp.
Heinz—Fifty seven.
Hupmobile—The "H."
Peter Henderson—An old man wheeling a barrow full of vegetables.
Bon Ami—The little yellow chicken.
Victrola—The dog, His Master's Voice.

The best known foods today are the advertised foods, such as Uneeda Nabisco, Heinz, Crisco, Postum, Grapenuts, Toasties, Libby's, Kellogg's, Sunshine, Quaker, Campbell's, None-such, Jello.

Some of these products have been on the market a great many years. Other products have become popular with the American public in a relatively few weeks or months. Some which were not known a few years ago, but which are very well known today, are Jiffy Jell, Lux, Grapelade and Life Savers. These were made popular largely through the mediums of the American newspapers, coupled with posters and railroad and elevated advertising.

Possibly Jiffy Jell is the best known gelatine product today and yet it is just plain gelatine. Life Savers were developed through advertising to a point that within a few months the owner refused to sell the rights to manufacture this confection for $1,000,000.

A few years ago an old man in Boston, who was foot weary, went down to a basement cobbler shop and got the man to put some rubber on his heels. He was so delighted with the result that he told friends and soon scores of them were going to the same cobbler. A bright advertising man saw that here was a good idea. He talked to the cobbler about it and wanted him to advertise on the elevated lines of New York and in the newspapers of that city. The amount necessary scared the old gentleman, but when he was told that he need not pay for the advertising at all unless it brought remarkable results, he consented, and within two or three years he had a patent which he sold for $250,000. This is the interesting story of the O'Sullivan heel.

Heinz and his famous 57 varieties are known to practically every school boy in the country today; yet, it was not so many years ago that Mr. Heinz did not believe in advertising. He did just a little on the street cars of Pittsburgh. Later he was induced to put a special booth on the boardwalk in Atlantic City. This brought remarkable results. He then tried advertising in the city of New York, putting attractive posters on subway and elevated lines. Soon he jumped into the national field and he has found that advertising pays. When there was a slump in our industry a year or two ago he increased his advertising fund as he said that was the time to advertise all the more.

Coca Cola is the most popular drink in the country today, because that concern has placed a drink on the market and has advertised it in a way that everybody knows it. They spend probably over a million dollars yearly and sell six million drinks a day.

Quaker Oats was probably the first food ever advertised to the public in the United States in a national way and this food is one of the best known today because three million dollars are spent annually in keeping this product before the American public.

In 1911 Ward's bread was put on the market and bake shops were established which would handle 900,000 loaves a day. Ward began to advertise in New York, putting very attractive posters along the elevated lines. In nine months he had passed the capacity of his output and had to build large, new bakeries.

Recently Fleischman's yeast took hold of the idea of vitamines and

in fourteen and one-half days were able to introduce that product into 3,000 soda fountains in the east. This was done through newspaper and car cards.

In 1895 C. W. Post, of Battlecreek, started in to manufacture Postum Cereal. He had very little money with which to start. In 1897 he brought out grapenuts and in 1906 he developed a cornflakes product known as Post Toasties, and it now takes 15,000 bushels of shelled corn a day to suppy this demand. Post found that advertising pays. His results were so gratifying that he became very enthusiastic and the total amount of money spent by this firm today has passed the thirty million dollar mark.

Everyone in the United States has been attracted by the very beautiful poster which the Palmolive people have placed in every city of the United States. A short time ago this concern was spending $5,000 in one state of the Union. The results were so gratifying, however, that they immediately enlarged their program to include $1,000,000 annually for posters alone.

One would think that cigarettes would not need advertising as nearly every man uses cigarettes and yet, the Camel Cigarette Company alone spends $3,000,000 in billboard posters.

Del Monte, the best known canned goods by far in the United States today, spends a sum annually in excess of $1,000,000. They advertise in women's magazines, newspapers, elevated lines and posters.

By far the best known soup in the United States today is Campbell's soup. This is a high-grade soup but the manufacturer spent $1,000,000 introducing it to the American public and has been a consistent advertiser. Last winter, while visiting a big jobber in a Texas city, he showed me the large stock of Campbell's soup which he carried. He turned around and showed me a smaller stock of a brand which he said was just as good but he said, "You know the women in Texas have been sold on Campbell's and they won't take anything else." He then showed me two piles of breakfast foods. One was very large, the other was small. The large one was Post Toasties and he said, "That small pile is fully as good, perhaps better, but Texas women don't think so because they have been entirely sold on Post Toasties."

This is not an exceptional case. You can go into any city of the United States and find men who will talk to you in just the same way. The advertised foods are the ones which people are calling for. The big meat packers have spent huge sums. A firm like Armour & Company of Chicago, with their "Veribest" brand of meats and groceries, have been in the habit of spending three or four million dollars annually and as a result their products have become nationally known and are in big demand.

Up to comparatively recently food advertising, we see, has been confined largely to concerns who manufacture food products, such as meat, fruit, canned goods, milk, fruit juices, cereals, beans, etc. Beginning with 1907, however, we find that the producers started to enter the field of advertising. Some thirty years ago the orange growers in California found that an organization was necessary in the development of their industry. They had reached the point where 2,000,000 boxes of oranges

were more than the country would seemingly consume. By 1904 the crop had reached 10,000,000 boxes and was ever on the increase. In addition there were many lemons coming on, the Valencias or summer oranges were being planted, and there were imports and considerable competition from Florida. The California Fruit Growers Exchange spent $15,000 in 1907 in the middle western states. They have increased that sum until now it is probably at least $1,000,000 annually and the crop of 1920-21 consisted of 22,000,000 boxes of oranges, or about 40,000 carloads, and enough lemons and grapefruit to bring the total tonnage up to 60,000 cars, worth $66,000,000. Even this year there are 35,000 cars of oranges and probably ten or eleven thousand cars of lemons, and Florida expects to handle at least 15,000,000 boxes of oranges; yet, there is no decline in the orange market. They are being distributed and advertised and will be sold at a profit to the growers. They are not worrying very much about financial conditions in the country, low trading conditions, etc.,—their product is advertised and it is moving.

California found that up to 1909 people did not east oranges in the summer time, that they were having great difficulty in getting rid of their summer oranges or Valencia, which at that time consisted of a third of the crop. By advertising and hard work they got the consuming public to buy at least half of their tonnage of oranges in the summer time and today the Valencias represent about half the tonnage of the oranges in California.

Lemons used to be almost entirely sold in the summer time, or perhaps during some epidemic. Now lemons are bought practically every day of the year and California supplies 83 per cent of the lemons consumed, in this country.

What greater tribute do you want for advertising than this great triumph of the California Citrus growers?

Only a few years ago the California walnut growers were in a very bad way. They organized, got out a good brand, the Diamond brand, and advertised it as a "Crackin' Good Walnut." They put up vacuum packs, they graded them skillfully, but they began to advertise until they got their budget up to about half a million dollars annually. Their crops have been ever increasing. The crops between the years 1917-19 were practically double those of previous years. Yet, through their advertising and skillful merchandising they are handling the ever increasing crop. This year was one of the largest in their history and yet it is being sold at a big profit to the growers.

Up to 1907 walnuts were largely imported in this country. By 1920, out of 56,000,000 pounds consumed, 39,000,000 came from California. In 1921, out of 87,000,000 pounds eaten in this country, 41,000,000 came from California. These were sold practically under one brand, were nationally advertised and a bigger business is being developed annually.

The raisin story is an intensely interesting one. Up to 1913 raisins were in a very bad way as far as the grocers were concerned. At times raisins were down to a fourth or half a cent a pound and it costs three and one-half cents to handle them in the field. In 1913, the year the California Raisin Growers were organized, the crop was 132,000,000

pounds and there were some 20 to 30 million pounds carried over. You know what that means—dumping these raisins on the market and at the time the new crop comes on it demoralizes the business. They concluded they would try advertising. A budget of $119,000 was used in that year. They made investigation of the bake-shops in the United States and they found they were using only 700 tons of raisins a year. They introduced raisin bread, raisin pie, and in four years they increased the consumption of raisins in the wholesale bake-shops from 700 tons to 45,000 tons. Now, in the year 1920, we find that they produced 347,000,000 pounds of raisins and had no carry over. The crop annually now is at least 250,000,000 tons and next year there will be a remarkable increase, at least 150,000 tons. The per capita consumption of raisins in the United States since 1913 has been increased from 1.1 pounds to 3.28 pounds. We are all eating raisin pie, raisin bread, raisins in our cereals, and we are all asking ourselves if we have had our iron today.

A large sum of money is now being spent in Canada and $300,000 in Great Britain. The total budget of this organization today is two million and one-half, spent annually for advertising. A remarkable development. On July 17, 1921, they produced the little red nickel package of raisins. Many pooh-poohed the idea and thought it would be a failure, but by the middle of October they sold 17,000 tons, or two and one-half million cases, being 331,000,000 packages for sixteen and one-half million dollars. By March of the next year the sales had reached a total of 660,000,000 packages. One of the most remarkable merchandising stunts that was ever pulled off by any concern in America and it was done through advertising.

You are perhaps wondering what all I have said has to do with the marketing of apples, peaches, plums, as you are growers of these kinds of fruits. I will show you that there is a very close connection. In 1899 we were handling, at point of origin, about four and one-half million tons of fruit and produce. At the present time this has grown and we are handling now from 16 to 19 million tons, or an increase of about 300 per cent. This means that there are about a million cars of fruits, vegetables and canned goods handled at point of origin in this country annually. We find that the banana, orange, raisin, prune, walnut and almond have increased their tonnage remarkably from year to year, and with the exception of the first group, they are all handled cooperatively. The banana is handled by a private concern but handled very efficiently indeed, 45 to 50 million bunches odd annually. We find that berries have been in a profitable condition because during the war we allowed the acreage to decline tremendously and we have not as yet quite the acreage we had in pre-war days. The grape is in a very healthy condition owing to the remarkable demand for both California and Eastern grapes, due to prohibition.

We do not find, however, that peaches, apples, plums, and similar fruit have kept pace with the advertised, standardized fruits. The pear is in a very fair condition because the tonnage of fall pears is relatively light. The Bartlett pear is very largely canned and the fresh market has been very intelligently handled through a good advertising

effort of the California Pear Growers Association. They are spending a large sum of money in our large centers like Boston, New York and Chicago, and they are increasing the consumption and they are keeping the market in as reasonably good condition as one could hope for.

With apples there has been only a limited amount of advertising. The Skookum people have done probably the best apple advertising in America and their apple is the best known. They have used elevated lines, newspapers and magazines. The Hood River people have done some very intelligent advertising in some of their principal centers of distribution, using large billboards. Now the Wenatchee Valley has gotten together and they are spending $175,000 this year in two or three magazines and newspapers and elevated lines and they are going to put the thing across. In Chicago where I live Wenatchee apples are being very cleverly and intelligently advertised and it is going to help the Northwest boxed apple out tremendously, and especially Wenatchee. You will find in Australia that they have raised a budget of one cent a box and they advertise Australian apples in England; but on the whole, this is only a drop in the bucket. Very little money is being spent on apples, peaches, plums and similar fruits. Such products are being very largely dumped onto the market. There is very little warning as far as the consumer is concerned. The fruit is allowed to pass through far too many hands, not intelligently distributed and not advertised at all. We have practically, under our present methods of handling these fruits, reached the saturation point, that is, when we produce more than 25,000,000 barrels of apples annually and more than 40,000,000 bushels of peaches annually, we reach the point where the grower cannot sell them at a profit. If he holds them he has to do so at a sacrifice. This condition is wrong. We should consume two or three times this tonnage in a country such as ours.

Now, you will say that you cannot organize the apple like the orange. That may be true and while it would be highly desirable if we could have the apples of the United States in relatively few hands, which would mean better distribution and advertising, still this may be impractical and it is not necessary. We find that in business entire industries advertise regardless of the firm or brand. Look at the advertising the national canners are carrying on, the White Pine Lumber Manufacturers, the brick manufacturers, paint manufacturers. In Chicago I recently found that sauerkraut manufacturers are all getting together. The Hawaiian pineapple has been advertised nationally, regardless of brand, and now the Chicago wholesale grocers are advertising eggs and butter and no brand name is mentioned.

Industry finds that it pays to advertise manufactured products, that the individual manufacturer always gains business from a national campaign even though his name is never mentioned. It would be wise enough to supplement this campaign with a little advertising of his own and reap a big benefit. Apples could be organized in a certain way by getting districts together like the Pacific Northwest, or the apple district of the Michigan apple growers and some of the money could be raised to advertise apples and peaches so as to give the consumer a warning of crops, of varieties, and get them prepared to buy. We must get

the consumer rapidly out of the idea of thinking that fruit is a medicine on the one hand or a luxury on the other. While some work has been done in showing that fruit contains vitamines and iron and by the old slogan that "An apple a day keeps the doctor away," still such advertising is only a drop in the bucket. We must show the American public that fruit is a palatable, healthful, economical food, that it pays to buy it from a dollar point of view. If the deciduous fruit growers will get together in a way so as to advertise apples, peaches, and plums, and similar fruits, in the same way that manufactured foods are advertised, or the orange and raisin are being advertised, there is no reason why an equally good response should not be received, but as long as we simply grow fruit, dump in four or five big centers, neglect the educating of the American public through good literature in magazines and papers which they read, and through intelligent advertising, we must in the future expect to reap just what we are getting at present.

The solution of these problems of the fruit grower is in your hands. There is going to be no Moses to come from the bullrushes and lead you around and guide you across the deserts to the land of prosperity. The trail has been blazed. You can see the handwriting on the wall. Wherever others have gone, you can follow. The future of American apple, peach and plum growing is in the hands of the grower. If he is intelligent in organizing, marketing, distribution and advertising, he will reap a great reward. If he refuses to take these steps he must accept the penalty.

Question: Why are a great many hotels and restaurants charging as high as twenty-five cents for baked apples and getting away with it? If something could be done to make the price of apples more reasonable there would be more consumed, wouldn't there?

Mr. Lewis: Yes.

Question: And that might do more good than to spend several hundred thousand dollars in newspapers.

Mr. Lewis: What are you doing to start that?

Question: Nothing in particular.

Mr. Lewis: That is it. You are doing nothing in particular. Who is?

Question: The man who grows the fruit.

Mr. Lewis: Well, assume that you are a fruit grower. You are doing nothing to stop that. And if I ask the average fruit grower in the United States, his answer would be the same, "I am doing nothing to stop it, but it should be stopped."

Let me illustrate: There was a car of lemons sold in Chicago. I was down at the auction when this car came in. It reached the market in pretty good shape. The fellow who sold it to the

other man made $2,200 profit. And I am willing to bet that the man who grew those lemons lost money on it. Now if that man had been selling a car of Sunkist lemons, how many cars would he get for the remainder of his life? He would never get one. That would be the last car he would ever get.

Referring to these same pears that I told you about before—when they started their campaign they went to the retailer and said, "You can't sell your pears from California in the way you have been selling them, charging five, six and seven cents apiece. You can't do it. But look here: If you sell so many boxes a day you may make a certain margin of profit on that and you get a quick turn-over and you make more money, and you have no breakdown." And they put that campaign over. And that is why they sold about twice as many pears in Chicago as they ever did before.

The point I want to make, in answer to your question, is that while some restaurants and hotels charge too much for baked apples, that is only a drop in the bucket. But we will not correct it just sitting here. The conditions can only be corrected by working in big business masses. You can't speculate with bananas. If you try to speculate with bananas in Council Bluffs, you would go broke in two weeks. You can't speculate in Sunkist oranges, you can't speculate in raisins, in prunes or in walnuts in Iowa. Let me ask you, why should you speculate with a food product? No man in the United States should have a right to speculate on a food product. (Applause).

Question: Very few people buy oranges at that price.

Mr. Lewis: Let me tell you something. The wholesale price of oranges this summer was $8.50 to $11.00 a box, and they sold every box; but peaches are going begging.

Question: Wasn't the crop reduced?

Mr. Lewis: The crop was reduced, but they wouldn't let Chicago have one box that they couldn't use, and they advertised it in the papers there. They had 35,000 cars of them. You forget, possibly, that when you went into the grocery store and bought those oranges for sixty and seventy-five cents a dozen, they were very large.

Question: Whatever happened to the plan that the society started two or three years ago down at Columbus to organize the apple industry and put on a selling campaign?

The Chairman: The marketing proposition?

Question: Yes.

The Chairman: We will hear more about that right away. Somebody else can answer that. That was brought up and was seriously considered, and about that time a movement was started by the American Farm Bureau, which appointed a committee of twenty-one representatives from all over the country. We were told they were working at that marketing end of the problem. Temporarily, until we found out what they were going to do, we held up further work. And as a result they have gone ahead and have had a number of meetings and they have organized the Federated Fruit and Vegetable Growers. The manager of the concern, Mr. A. R. Rule, was to appear, but he was unavoidably detained, and Mr. Nicol, of the Board of Managers of the Federated Fruit and Vegetable Growers, will now give you an address, and I think he can answer that question. Mr. Nicol. (Applause).

THE FEDERATED FRUIT AND VEGETABLE GROWERS' INC.

James Nicol, South Haven, Michigan

They say in this world that there is no loss without some gain. Your misfortune today is not having Mr. Rule here to address you. My good fortune is being here in his place, listening to this splendid educational program, meeting old friends, and I hope making new ones.

In making a report to you of the activities to date of the National Fruit and Vegetable Association, I feel a good deal like I am reporting to headquarters. It was largely through the activity and help of the members of this society that we have proceeded as far as we have in the organization process. There are a great many men in this room today who have given us active assistance. So far all we have done has been to outline the plan that we expect to follow. We commence active operations on the first day of next January, and the outstanding feature of our organization is that it is to be owned and operated by the growers.

Now I don't mean by that that the growers as going to turn in and directly sell their own products. But no director of the association would be elected that doesn't represent the growers' interests. No member of the directors or executive committee will be anything but a grower. Furthermore, no member of the directorate or no member of the executive committee will receive a salary. The salaried man will be the man that sells the goods, that advertises the goods, that shows us the way to profitable distribution.

The first meeting of this committee of twenty-one was held last November. Several meetings have been held since then. The committee was gradually reduced, until a board of directors, composed of fifteen members, were planning the incorporation. They were finally ordered to incorporate, which was done within the last sixty days. We are incorporated in the state of Delaware, because Delaware offers a broader charter than the average state. Different laws in different states make it necessary for us to have a charter that can be adapted to the different laws of every state.

Any cooperative association desiring to become a member is welcome. Their application will be referred to the executive committee, and there is nothing to prevent them from becoming a member; only that we would like to know what they represent, as it is absolutely important that grades be standardized, that somebody be back of them.

Now it is possible that some individual grower cannot be served by a cooperative association. That being the case, if he has got a standardized product, a quantity sufficient to demand the services of this association, there is no reason why he can't be admitted. On the other hand, if it is one of those men that never can cooperate with anybody, where he has a good chance to work through a cooperative association, he will not be admitted to the service of the national organization, unless the local cooperative association which he should belong to gives its consent.

This isn't to tear down any organization. Now we find those men (they are a great minority, but we find them) in almost every district in the United States.

The manner of electing those different directors is somewhat like this: If there were in this state an apple association, we would prefer that those co-operatives here meet annually and elect one member to represent the apple interests of the state of Iowa. The potato man would have the same right. So would the grape man. They would be the directors. Now that would apply all over the United States. Citrus men, potato men in Wisconsin, Michigan, New York and Maine would each elect a director. The grape men would elect a director. The tree fruit men, the small fruit men, etc., onions and celery—because these men will represent those interests especially.

Now this directorate will naturally be a large body, and each director's expenses are met by the association that sends him to the annual meeting. There probably won't be any necessity for more than one meeting per annum of this directorate. This directorate elects the president, the vice-president and executive committee of five to manage the business of the association.

In addition to that, there is an advisory committee. Now the advisory committee would consist for every different commodity of the representatives of that commodity. In other words, the Irish potato men would be the advisory committee on anything pertaining to potatoes; the sweet potato men would have their advisory committee. That advisory committee can get together whenever they think their interests demand it. They can be called together by the manager. When they are called together by the manager, their expenses will be paid out of the tonnage. When they call themselves together, their individual associations will pay the expenses of the delegates.

Now after they have decided on a policy or a problem that confronts that special committee, they report it to the executive committee, and their instructions are followed. That makes it grower-owned and controlled. The grower is telling how he wants his product handled, and that commodity is taking care of their own expenses.

The executive committee, as chosen by the board of directors, at present represents one gentleman who lives in New York, another in New Jersey, another in Florida, another in Illinois and one in Michigan. I think the idea of the directorate in picking out that committee was the fact that all those directors were within a night's run of New York and Chicago and could be called together in less than one business day when necessary.

The president of the organization belongs to the California fruit exchange. And I think he was a wise choice, because he comes from the outstanding cooperative organization in the United States. The benefit of their experience can't help but be of a great deal of advantage to this new organization.

Now how is this organization going to be financed? I might state or ought to state that we have purchased the North American Fruit Exchange. A committee of growers, consisting of Mr. Edwards of California, and Mr. Peet, assisted by an attorney, examined the books and

the properties and decided on a price. That price couldn't be exactly determined, because the bank balance of this organization on the last day of this year has to be taken into consideration; also if they have any outstanding debts at that time, they have to be deducted.

Any property, such as advances to different organizations, packing houses, etc., that are owned by the North American fruit exchange, this organization does not buy. It doesn't buy packing houses. The North American fruit exchange can liquidate that; or, better still, they can sell them to the local organizations as soon as they are able to pay for them. In some parts of the United States those packing houses are a necessity. And at present the local growers there could not finance a purchasing agreement. And we don't want those packing houses to fall into the hands of unfriendly interests. That was the reason that it was decided to leave them with the North American fruit exchange until such time as they could be liquidated into friendly hands.

Now, how are we going to pay for this property that we have bought? We have bought a going concern and it takes quite a lot of money to pay for it. We make no payment until a year from next December. We have five years or more to pay for that property. And it is going to be paid for on a tonnage basis, using the revolving fund. There will be a charge made for every car handled. It may be a dollar or it may be two dollars per car. If we handle 40,000 cars next year, that might be $80,000 that we collect on this two dollar charge that is put into this revolving fund. Now that is not a reserve fund. It is a revolving fund. In addition to paying for this property that we have bought, we want to establish a capital. I don't know what the capital or the amount ought to be. You are just as good a judge as I am. It might be a quarter of a million dollars, it might be a million, it might be five million; and it will be, before you get through; but that is a good many years hence.

If we had a moderate sum of $80,000, it would pay for this organization in a good deal less than five years and put up a very respectable capital. But we will say, for argument, that we take five years and we take $2.00 a car. Now if our business didn't increase we would have to take as much the first year as we did the second year. Perhaps by business increasing, we don't need as much per car. Then again, if we took as much per car we would pay for it just that much sooner. So perhaps it will be just as well to have that same charge of $2.00 a car, we will say. I can't say what that charge would be.

Well, after we have paid for this, after we have our capital, what happens then? We still take the same amount—$2.00 a car—and we return that. We will say that this is the sixth year. We return that to the cooperative associations or individuals that furnish the first money—that $2.00 per car the first year. On the seventh year we would return it to the second, the eighth year to the third, etc., making just what it is called—a revolving fund.

Do you ever stop to think of the community work that has been done in cooperative associations by everybody that has ever been interested in the community, for which you get absolutely nothing, very often not a thing? You pass away and your interest in some of those member organizations passes away with you. If your son wants to succeed you

in the business, he has to join as a new member. It is just like somebody standing back and saying, "Well, when this is a going concern and everything is going fine, I am with you; but I won't start with you."

Now this revolving fund makes that man start just where you started. He pays just exactly what you pay. I think it is the fairest way of starting a cooperative organization that ever was worked out. We are largely indebted to the California Fruit Exchange for some of those ideas. The men that are doing the business will pay the expenses of running that organization every year that it operates.

There is an initial charge for membership which practically amounts to nothing. That is ten cents a car. I think the attorney said, "We will call that an entrance fee, but we will make it an annual fee."

Now in a cooperative association in this neighborhood, I don't imagine you would have in fruit more than one or two or three hundred cars. What would it amount to—ten cents a car? In the aggregate it amounts to a lot. Just the entrance fee for the California Fruit Exchange, whether they ever sold a car or not, would be $5,000 on their average year's business, just their membership dues. And I want to tell you that those California people say well and good. They suggested it themselves. They will carry a large part of the burden of the initial expense on just that ten cents a car entrance fee. On an old association, it is figured on your last year's business; on a new association, merely on an estimated tonnage.

We will be glad to have applications for membership sent to the secretary's office, either at Chicago or the New York office. They will be of equal importance.

The great problem that we have before us today is to get the men that can furnish the ability to advertise our fruits, as outlined by Mr. Lewis, to help in the organization of different cooperative associations where they have none, and most of all in the distribution and sales of our products. For you men that represent the educational institutions of our country, there is a field that we want you to put your best talent back of. Educate some of those young men in the selling and marketing, advertising of our products. We have got to have them. There is a crop that hasn't been grown. We have applications from co-operative associations today that will pay good salaries for good service. In fact, I was at a cooperative meeting inside of a year where a manager was offered $1,000 a month salary by a local cooperative selling association. And what do you suppose he told me? He was frank with me. He said, "I can make more money buying your fruit than selling the fruit for you." And he told the truth, and he turned down that salary. Now we don't want that man. He didn't have the cooperative idea in selling the fruit. He told us the brutal truth that we knew, and we thanked him for it. But when we are ready to pay such prices as that, isn't there a demand for that service?

We haven't got our organization man appointed yet. We want a man of the type of Mr. Harold Powell. Where is he? We are taking time. We hope to get some man. We will get a man, but you can't get him on short notice.

In regard to the business that we are going to do, we aim to start

in a moderate way. A good many of our farm propositions have been overwhelming. There is a demand for the services there, but we are not ready to render that service. We have got a going concern, and we have employed Mr. Rule as general manager. But Mr. Rule has not employed all the men in the North American employ at the present time. That is up to him. He can pick out the men that he has got there. He can get better men, if such a thing is possible.

We hope next year that our tonnage will not exceed 40,000 cars. We want to test this organization. We want to test out the men in our employ. Now, 40,000 cars is a very moderate amount compared to the tonnage of perishables. We have got in sight at the present time 30,000 cars. So we have only got to get 10,000 cars more before harvest to have our 40,000 cars. We don't expect that an old organization like the California Fruit Exchange is going to come right in and say, "Take all our stuff and sell it." They have a fine selling organization. But we do expect confidently that the California Fruit Exchange is going to help us and divide the expense in a great many instances with us in the distributing center. That is to say, if they had an office in Council Bluffs or Omaha, that same office, the same office force could be used by both the California Fruit Exchange and by the Federated. The day will come (I know that the California people confidently expect it) when the auction sales in the large cities will be owned by the growers jointly. They are with us in that. Instead of having them private concerns, they will be owned and operated by the growers. That is a point on which we can get together with the California Fruit Exchange just as soon as we are ready and have sufficient tonnage to operate in an economical way.

We need help. We have come here asking that. They say it was the largest proposition in cooperative marketing that ever was attempted in the world. But that is no reason why we shouldn't succeed. And I might say right here that we started simply as the National Fruit Organization, and we were very diffident about adding that word "Vegetable." But Wisconsin and New Jersey made a strong plea, coming from the potato interests in those states. The motion was made by a potato man in Wisconsin that the word "Vegetables" be added. That is the reason that it is now the Fruit and Vegetable Organization. The arguments were all in favor. A man that sells fruits can just as well sell vegetables.

I would like to show you the tonnage map of the 30,000 cars that we have practically secured. It goes up to a peak in September and October and runs moderately the balance of the year. Now by putting in the potatoes in the early months of the year, we will reduce the overhead. If we can put in the citrus fruits from now until the strawberries begin to move, that will greatly reduce the overhead. We have got quite a proportion of the citrus fruits in Florida that will be handled through this new organization. In California we are offered 5,000 cars of oranges. But it doesn't come from the California Fruit Exchange.

Now we are co-operators and we say to those men in Florida, "What is the matter with the California Fruit Exchange? Why can't you come

in as a state? We are not there to try and start a rival organization." Our advice to them is, "Go and use the organized co-operative exchange of California. Come in together."

How that matter is going to be settled I don't know. But I don't think that they would object if we take that tonnage. We are not there to try to tear down co-operative organizations. We are there to build them up.

I was very much interested in a question that a gentleman here asked about the cost of buying an orange. You have got an apple show, as fine a display of apples as I ever saw. I was there last night, and, of course, I got apple hungry. I bought an apple. I know what I paid for that apple. I would pay $45.00 a barrel if I bought them on the cost basis for that one apple. I know just how many apples there are in a barrel.

That is one of the problems that we are going to try to help solve. As Mr. Lewis, in that remarkable paper pointed out to you, you see apples advertised—Wenatchee, Hood River, Skookum. You have got apple experts in this room, a large proportion of them. I will venture to say, if I brought you in Jonathan apples from Illinois, Michigan, New York, Wenatchee, and asked you to tell where it came from you couldn't tell; that is, the majority of you couldn't. There might be one or two that could tell. The advertising that those gentlemen are doing is helping the whole apple industry where it is presented. And it is unfair. Why shouldn't the advertising of the apples of the United States be carried by the apple men of the United States? It is up to you as an industry, whether you choose to eat an Iowa apple, a Michigan apple or a Washington apple, to do that. But if you get into the habit of eating apples you won't stop because the supply is exhausted in one state.

Now we would like as an advertising problem (this is just a few of the suggestions that have been talked over) in such an exhibit as you have in your city, to present everybody every time they come in there with an apple, if they will eat it or take it home and make somebody eat it. (Applause).

Now it isn't fair to ask the Iowa Horticultural Society to carry the burden. That is a burden of the apple men of the United States. That is co-operation—doing the same thing at New York, doing the same thing in every other state, getting people into the habit of doing it.

Supposing on a Tuesday we should commence in an industrial plant or in a large office building in a big city and at 10 o'clock we should have a score of boys go in and hand everybody an apple that was suitable to eat at that date. Say, we keep that up for a week. At 10 o'clock every day they would get an apple. Then on the following Wednesday we would go over there with apples again and tell them that the doctor has said that the man who was doing this was in danger of dying, enlargement of the heart, and it was a business suggestion, and today we would have to charge them a fair price for that apple. Don't you believe that fifty per cent of those men will have had the apple habit by that time? If it came to 10 o'clock, they would have missed it if you didn't present them with an apple.

I wonder if you have ever thought where the apple consumption of

the United States is. Mr. Lewis told you that all refrigerated perishable fruits in the United States amounted to something like one million cars. If everybody in the United States consumed one apple a day, it would take 565,000 cars to fill that demand. That is just one apple a day. (Applause). Why, we haven't scratched the surface of the consumption of fruits.

I am just talking about apples, because we have got into the habit and we have an apple show here; but that same thing applies to all other fruits.

Now in some districts a man will say, "Well, it is all right. I am doing fairly well. I don't need any cooperative association." That is the greatest mistake a fruit grower can make. You can establish the finest local or distant trade for your commodity, but there is a limit to fill in that demand, according to your acreage. Now, if you are going to advertise, if you are going to build up a trade, when you get a return on it, if you can't fill that, you are practically out of business, you are forgotten before your next crop comes along. No man can stand alone in marketing his crops successfully.

I can say this, for I haven't sold a pound of fruit, relatively speaking, off my farm in the past twelve years. And nothing pleases me better than when I hear a man going by the place and saying, "There is no use stopping at that old geezer's farm. You couldn't buy his fruit on a bet." And he can't. The salesman sells my fruit. Why should a buyer drive out to my farm and pass by the co-operative association? There is only one reason in the world—because he thinks he can do better buying from me than he can from the co-operative association. It costs him money to travel.

Now, in closing, I just want to ask for the support of every man that represents the educational (if you will allow me to call it so) feature of agriculture, for the support of every man that represents the market. We are not going to do it as individuals. We are going to do it in a national way. Perhaps, you will remember in our school books, they used to tell us of the glories of ancient Rome, as McCaulley used to describe it, when none stood out for a body but all for the state. That is the spirit. We want to go into this co-operative work and hope confidently for success.

THE FRUIT CROP OF 1922

Verne H. Church, Agricultural Statistician for Michigan, Lansing, Michigan

It is certainly an honor and a pleasure to meet with an organization such as is in session here; one that is interested in an industry that requires a very high type of scientific skill on the part of those engaged in it; one that is fostering a highly intensified type of agriculture; one that is interested in the production of the most beautiful, healthful and useful class of Nature's products; and one whose members have seen the fruit and fruit products of a single season reach the enormous valuation of $754,000,000. This occurred in 1919, the crop of 1920 having a slightly less value, and that of 1921 an estimated value of $525,100,000. This decrease was mainly due to the light crop of orchard fruits in 1921. The above figures represent about five per cent of the total value of all farm crops, and those relating to the 1919 crop show an increase of 230 per cent over the corresponding value in 1909. The only other crops exceeding this valuation are corn, wheat, oats, hay and cotton.

The apple, the fruit that is adapted to a greater variety of uses than any other, and which can be made available in its fresh state throughout all of the months of the year, is grown in every state and nearly every locality where agriculture is possible. Therefore, it will be my aim to dwell more fully on the statistics relating to it than to any of the other fruits.

The federal census of January, 1920, showed 115,309,165 bearing trees in the United States, or 24 per cent less than shown by the census of 1910. The number of trees not of bearing age was reported in 1920 to be 36,195,085, a decrease of 45 per cent since the previous census, indicating that the loss of 24 per cent in bearing acreage already sustained between 1910 and 1920 would probably be still greater during the next few years because of the reduced plantings. However, it is interesting to note that the average annual production for the last five years, 161 million bushels in round numbers, is greater by seven millions than it was for the same period ten years ago. This leads to the conclusion that the average yield per tree is considerably greater now than it has ever been in the past, that the process of evolution or survival of the fittest is actually at work in the apple industry, and that advancing scientific methods are literally bearing fruit. Included in this five-year average of 161,000,000 annual production was the exceptionally light crop of 1921 when only 98,097,000 bushels were harvested, the lightest since 1890, when our population was only 60 per cent of what it is now. In contrast to this extremely light crop, which was 40 per cent short of normal, we have just harvested a crop estimated at 205,539,000 bushels, or nearly 28 per cent above normal. These figures refer to the total agricultural crop whereas every fruit grower is primarily interested in the commercial portion only.

This portion normally is about one-half of the total production but varies widely from year to year according to the size of the crop, the percentage being highest in years of light production and lowest in years of heavy production. In other words, the commercial production is far

more stable in volume than the agricultural. It is, indeed, unfortunate that figures on the commercial crop are not available for more than a few years back. During the years of the World War, when emergency funds were available, a special reporting service on commercial fruits was inaugurated by what was then the Bureau of Crop Estimates. Fruit specialists made surveys of the commercial areas and monthly reports on condition. These reports proved to be extremely valuable but, with the cutting off of the special funds for this purpose at the close of the war, it was necessary to discontinue the work and the services of these men. Since that time only feeble efforts at estimating the commercial side of the crop could be attempted, although it would seem that a few thousands of dollars spent along this line would be of untold value to the fruit producers of this country. However, it does not appear to be possible to secure such an appropriation from congress unless concerted action is taken in that direction by those who would be directly benefitted.

Between 25,000,000 and 26,000,000 barrels is the average annual commercial production for the last five years. Last year it dropped to 20,098,000 and this year it promises to reach 31,901,000 barrels. In 1920, it reached 34,000,000. In that year, 31 states of the Union produced 97 per cent of the apple crop, none of which had a total production of less than 1,000,000 bushels. Among these states are eleven that are producing 68 per cent of the total crop and 77 per cent of the commercial crop this year, none of which had a total of less than 6,000,000 bushels. These eleven states are: New York, Pennsylvania, Virginia, West Virginia, Ohio, Illinois, Michigan, Missouri, Washington, Oregon and California. There are other states that outrank some on this list in occasional years so that it is not, strictly speaking, a list of leading states.

The October 1 condition in this group shows a percentage of 71 or better in seven states, Pennsylvania reported 63, and the states of Virginia, West Virginia and Ohio were 50 per cent or below. These last three, together with portions of Pennsylvania and other states in the same region, suffered severely from a late spring freeze that materially reduced the setting of fruit on the trees.

The quality in all parts of the country is generally up to the average or better. The only exception was reported from Idaho where a great variety of troubles occurred rather than any particular prevailing one. A report on September 1, by the New York State Horticultural Society, states that 58 per cent of the crop would pack "A" grade as compared with 59 per cent last year and 70 per cent in 1920. The State Horticulturist of North Carolina estimates a loss of 40 per cent, due to insect pests and diseases. It may be of interest at this point to mention the results of the bureau's investigations of the causes of losses to the apple crop. For the years 1912 to 1920, inclusive, the average losses amounted to 39.5 per cent, divided as follows: climatic, 25.6; plant disease, 3.9; insect pests, 3.3; animal pests, 0.1. Of the climatic losses, 4.9 per cent were from deficient moisture, 1.7 from excessive moisture, 15.7 from frost and freezing, 0.8 from hail, 0.2 from floods, 0.5 from hot winds, and 0.9 from storms.

Our statisticians report that the car shortage has not been a serious factor this year, although there was some local difficulty in getting cars spotted in heavy producing sections at times, and some losses through delay in getting cars to handle early varieties. There is also difficulty in securing cars for the late crop in some of the far western states. Through fear of transportation troubles, buyers have been timid and as a result prices have been materially affected. The results of a questionnaire addressed to statisticians in the leading apple states inindicate that from 85 to 90 per cent of the movement is by rail, in car lots, the remaining ten to fifteen per cent being by truck and rail shipments in less than car lots. Of the rail movement, as high as 90 per cent is estimated as being shipped in refrigerator cars from some of the southern states, while in the northern states it is only about ten per cent. From 70 to 75 per cent of the crop east of the Rockies is shipped in barrels. Bulk shipments comprise about ten per cent, and the greater part of early varieties moves in baskets. West of the Rockies, the box is the favorite package, and is probably used for 90 per cent of the shipments. Bulk shipments are seldom made from that section of the country except locally for by-products and storage.

From the extremely short crop of 1921, 95,837 cars were shipped. From the large crop of 1920, 102,962 cars were shipped. The 1920 production was 130 per cent greater than the 1921, but the total shipments were only eight per cent more. The wastage and losses coincident with large crops, and the remarkable utilization of small ones is well illustrated by these figures and often causes doubts and suspicions in the minds of some as to the reliability and accuracy of the estimates. We also should not lose sight of the fact that in years of large production the natural distribution of the crop is much better and greatly reduces the need for car lot shipments, especially in sections where trucking is a considerable factor.

As to the prevailing market situation, early varieties brought only fair prices. From sections that were far removed from consuming markets, high freight rates reduced the returns to a very small figure. In the far northern states, where early varieties come into competition with later and better ones from central and southern states, considerable quantities gave almost no net returns and a portion of the crop was not harvested. No attempt was made to handle the inferior grades. For fall and winter varieties the market has been sluggish, buyers were slow in making their appearance and timid in their offers. Many individual growers sought and found their own markets or have placed their crop in storage. Most of the states report unusually large storage holdings.

It is not my province to attempt any predictions as to the future market nor am I a specialist in marketing, but there are some really hopeful signs. A low price at the beginning of the market season is a stimulant to large consumption and acts as a tonic to prices later in the marketing period. The crop is not as large as that of 1920, yet labor is much more fully employed and therefore enjoying a greater buying capacity. High freight rates, low prices, and weak demand will

largely eliminate the lower grades. Through this elimination, the total quantity to be consumed is not only materially reduced but the public appetite is improved, a factor which should not be forgotten. A peck of poor apples will last my family longer than a bushel of good ones, and the interval between the time the peck is finished and the next purchase is apt to be many times longer than between the end of the good bushel and the beginning of the next one.

Peaches

The peach industry in the United States shows a greater percentage of shrinkage in volume than the apple. The number of bearing trees in 1910 was 94,506,657 and in 1920, 65,646,101, a reduction of slightly more than 30 per cent. The number of trees not in bearing in 1910 was 42,266,243 and in 1920, 21,617,862, a loss of nearly 49 per cent. This decline in the industry has been due to heavy losses of trees by freezing, small and unprofitable crops in too frequent succession, and the greater profits obtained from other fruits produced in the same localities. The number of bearing trees in California in 1920 was more than 1,000,000 greater than in 1910, but the number not in bearing was more than 3,000,000 less. The statistician for that state estimates a probable increase in bearing capacity since 1919 of about five per cent. While the census shows a decrease of about 2,000,000 bearing trees in Georgia during the same decade, this is offset by nearly as large an increase in young trees. The tendency is to increase the acreage because of the decline in the cotton industry, due to the ravages of the boll weevil in northern Georgia. New York increased its number of bearing trees but has not planted as heavily of late and has but few young trees coming into bearing. Michigan lost nearly one-third of its bearing acreage and has turned largely to cherries rather than re-setting peaches. Missouri lost nearly two-thirds of its bearing acreage and had only one-half as many trees coming into bearing in 1920 as in 1910.

There are seventeen states that produced more than 1,000,000 bushels each of peaches in 1922, and may be classed as important producing states. They produced about 85 per cent of the crop this year, and are: New York, New Jersey, Pennsylvania, North Carolina, Georgia, Ohio, Illinois, Michigan, Missouri, Kentucky, Tennessee, Texas, Oklahoma, Arkansas, Utah, Washington and California. California alone produced about 30 per cent of the total estimated crop of 56,125,000 bushels for the United States. This is the largest crop produced since 1915 and the largest with that exception since quantitive estimates began, which was in 1899. Estimates on the strictly commercial portion of the crop are not available. The 1922 crop was approximately 70 per cent larger than that of 1921. The crop was very good in nearly all of the important states, except Georgia with 59 per cent, Pennsylvania with 65 per cent, Texas with 40 per cent, Arkansas with 68 per cent and Oklahoma with 69 per cent of a full crop.

The quality was generally above the average, except that some of the fruit was small in size in localities where the trees were too heavily loaded and not properly thinned.

The total movement for the past season, as reported up to October 1, was 35,519 cars, as compared with 27,066 cars in 1921, and 26,967 in 1920. The 1920 crop exceeded the 1921 crop by 39 per cent but the total reported shipments were 99 cars less.

The leading variety for shipping purposes is the Elberta, it being estimated that 90 per cent or more of the total shipments were of this variety. In California, from 25 to 35 per cent of the crop is utilized for drying purposes for which the Muir and Lowell varieties are the most popular, and 60 to 65 per cent for canning for which Phillips cling and Tustin cling are the two leading varieties.

While there was no serious car shortage in any section, the fear of transportation difficulties in August, due to the strike then prevailing in car shops, caused buyers to be timorous and low prices to prevail. Weather conditions were most favorable and as the season advanced confidence improved and prices steadily advanced in the northern states. The amount of wastage was relatively small and less than anticipated.

Pears

While there was a slight loss for the country as a whole in the number of pear trees during the ten years between the 1910 and 1920 census enumerations, there was a net gain of approximately 2,500,000 trees in the commercial regions. There was a marked increase in each of the three Pacific states, a loss of over 600,000 in New York and a slight loss in Michigan. These five states constitute the commercial area and had a total of 7,708,220 bearing trees in 1920. The total number of bearing trees in the United States at that time was 14,647,412. The estimated production for this year is 17,772,000 bushels of which nearly 11,000,000 bushels are credited to the above five states. The total production last year was 10,705,000 bushels and in 1920, 16,805,000 bushels.

The Bartlett and Kieffer are leading varieties. The New York statistician reports the former as comprising 47 per cent and the latter 40 per cent of the crop in his state this year. So far as known, similar figures are not available for the other states.

The October condition figures were as follows: New York, 93 per cent of normal; Michigan, 89; Washington, 80; Oregon, 77; and California, 82. The number of carloads moved in 1921 was 12,442 and in 1920, 14,950; this year up to November 4, 18,267. A considerable quantity is usually placed in storage for later marketing.

The quality was generally good and the principal waste occurred in sections isolated from markets. Fair prices prevailed in comparison with values of other farm products and the relatively large crop produced.

Plums and Prunes

The total number of bearing trees as reported in the census of 1920 was 20,452,293, which was about 3,000,000 less than in 1910. The number of trees not in bearing was 9,375,268, or nearly 2,500,000 more than in 1910. Of the total bearing acreage, a little over 60 per cent is located in the three Pacific states. California has 8,768,436 trees, or more

than 40 per cent of the total for the United States. Oregon has about 3,000,000 trees. The other leading states are: New York, Pennsylvania, Missouri and Idaho, each having between 400,000 and 750,000 trees.

The crop was large this year and there was much wastage in the north central states, due to the lack of demand and to prices that were too low to cover the cost of harvesting, packing, marketing and transportation charges. As the bureau of agricultural economics makes no official estimates on this crop, statistical information concerning the volume is not available except for the census years. In 1919, the crop amounted to 19,083,942 bushels, of which 13,200,805 bushels were produced in California. The quality was very good, except that the fruit averaged small in size in many sections where the trees were over-loaded.

Cherries

Cherries are extensively grown in western New York, northern Ohio, western Michigan, northwestern Wisconsin, California, and in local areas elsewhere. Those grown in the far west are chiefly of the sweet varieties such as Bing, Tartarian, Royal Anne and others. In the Lake region, probably 90 per cent of the acreage is devoted to the sour varieties, the Montmorency being the leading commercial variety. The Early Richmond is extensively grown as an early variety and the English Morello as the principal late variety. The plantings in California during the last few years have only been about equal to the number of trees that have died. In the Lake states the plantings have been heavy. Growers have found this fruit more certain in yield and of greater profit than peaches, hence, following the heavy losses of peach trees from severe winters, replacements have been of cherries. The net increase in Michigan amounted to more than 40 per cent during the decade ended with the year 1920. The advance census bulletin does not contain any figures on cherries, so that it is impossible to make comparisons between the different states regarding this crop. Neither is it possible to give production figures.

The bulk of the western crop was handled this year through a co-operative association of cherry growers and better prices were obtained than usual. The quality was good and there was very little wastage. In the Lake region, shot-hole fungus was prevalent and injured the fruit in many orchards, especially the later varieties. In many unsprayed orchards there was a total loss. The canning plants were literally swamped because of the heavy marketings of this off-grade fruit, and considerable quantities had to be rejected because of low quality and inability of canning factories to handle it as fast as necessary. Prices ruled lower than for several years. The leading packages in the east for shipping purposes are the 16 and 24 quart cases; in the west, it is the ten-pound box.

Apricots

This crop is mainly confined to the state of California, and very few figures are available. The crop last year was estimated at 105,000 tons, which represented 55 per cent of a normal production. This year the condition on September 1 was 68 per cent of normal.

Grapes

About 92.5 per cent of the bearing grape vines are in the states of California, New York, Michigan, Pennsylvania and Ohio, each ranking in the order named. Nearly 70 per cent of the total are in California. It is estimated that the total acreage of both bearing and non-bearing in that state is 600,000, of which about one-fourth was non-bearing this year. About two-thirds of the bearing acreage consists of raisin grapes, two-ninths of wine grapes, and the remaining ninth of table varieties. Plantings in that state have been heavy in recent years. In the other states, the 1920 census showed a slight decrease in the industry since 1910, but considerable planting has been done during the last three years. A report from Arkansas mentions the great increase in plantings there. While the census reported 607,240 vines, it is estimated that the number today is 2,160,000. Forty carloads were shipped from there this year, and probably three or four times that amount will be handled next year.

The California statistician estimates the total production of raisin grapes this year to be about 950,000 tons; wine grapes, 400,000 tons; and table grapes, 175,000 tons. Car shortage interfered with the movement to some extent and it is probable that another 50,000 tons would have moved as fresh grapes if transportation companies could have handled them. Because of this condition, they were dried either as raisins or dried grapes.

There was a large crop in New York, Pennsylvania, Ohio and Michigan. Except for small local areas affected with rot or presence of the berry moth, the volume of the crop was only limited by the system of pruning and the capacity of the vines to carry the load. While there was some frost injury in the spring, the vines made a vigorous growth and the increased bearing surface permitted the setting of a full crop. The October 1 conditions for the United States as a whole was 95.4 per cent as compared with a ten-year average of 81 per cent. California reported a condition of 96 per cent; New Yark, 98; Pennsylvania and Ohio, 90; Michigan, 93. The leading varieties in the eastern states are the Concord, Moores Early, Niagara, Delaware and Catawba. In California the principal varieties of raisin grapes are: The Muscat, Thompson and Sultana; of table grapes, Malagas, Tokays, Emperors and Cornichons; while wine grapes are of too many varieties to mention.

Small Fruits

Strawberries: More than 119,000 acres were devoted to this crop in 1919. Since that time there has been a decided increase in a number of states. Arkansas reports more than double the 1919 acreage. The quality was good in most of the commercial areas, and the total shipments this year amounted to 18,500 carloads which was 75 per cent greater than in 1921. The state of Tennessee shipped more than 3,700 carloads, which was more than double the amount shipped by any other state in the Union. The season's movement for the United States amounted to 166.500,000 quarts, which does not include the large quantity consumed on farms and in local markets.

Blackberries: The published data is insufficient as a basis for an intelligent report.

Cranberries: The November 1 estimate is for a total crop in the United States of 561,000 barrels against 373,000 last year. The Massachusetts crop was placed at 290,000 barrels, the New Jersey at 207,000, and the Wisconsin crop at 59,000. Oregon contributes about 3,000 and Washington, 5,000 barrels. The crop was of good quality.

Subtropical Fruits

Only brief mention is made of this class of fruits, as the interest in them is more localized and the writer's knowledge of them is extremely limited.

The orange crop for each of the last three named years has exceeded $60,000,000 in value. The crop in California for the year ended November 1, based on the October 1 estimate, is 58 per cent of normal, the small crop having been due to the severe freeze that occurred in that state last January. The crop in Florida was not affected by the freeze and reached 90 per cent of a normal yield.

The lemon crop in California was also light, the November condition being only 55 per cent as compared with 86 per cent one year ago.

The Florida lime crop was placed at 85 per cent as compared with 78 per cent one year ago, and the grapefruit production at 88 per cent as against 78 per cent last year.

California reports 80 per cent of a normal crop of prunes, 90 per cent of figs and 48 per cent of olives. The report of that state for almonds and walnuts is 76 per cent, respectively.

It has been possible to briefly touch upon the situation in regard to the different fruit and to point out the principal statistical features in connection with the 1922 crop. In conclusion, I merely wish to add that these statistics indicate that even in years of large production, consumption of fruit must be woefully light in a large percentage of the homes of this country. If every person were to eat, on the average, one apple each day of the year and our production was double that of the season just ended, there would be no apples left for pies, cider, canning or other purposes. We are making a poor start toward securing a greater consumption when in the height of the shipping season we are unable to obtain fresh home-grown fruits in hotels and restaurants even when located in the heart of important fruit areas and in cities and towns that are leading fruit shipping points. I fear this situation is altogether too prevalent.

As I view the situation from a statistical basis, the most important effort should be to stimulate consumption. Just as you have built up production and improved the quality of your products, so should the public be educated to utilize your products, and their appetites whetted for your fruit as they have been for the tropical and subtropical kinds.

THE FOREIGN TRADE OF THE UNITED STATES IN FRUITS WITH SPECIAL REFERENCE TO EXPORT MARKETS FOR AMERICAN APPLES

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Introduction

The United States is the greatest producer and consumer of fruit in the world. While importing large quantities of fresh and dried fruit annually from foreign countries, the United States is at the same time developing an export market for the fruit of which she produces a surplus.

Marketing for export is not essentially different from supplying the home market. To be sure, there are certain special requirements and preferences of the various foreign markets but these will also be found in the domestic markets. The problem of proper care and handling in transit is also one that perhaps deserves special attention. The purpose of this report, however, is merely to point out some of the peculiar characteristics of foreign markets and their special preferences, methods of sale, etc., and in general to summarize briefly some of the chief problems that must be solved by those who engage in the marketing of fruit for export.

No attempt has been made in this report to discuss in detail the method of preparation, packing, and grading of fruit for export. For more complete information on these subjects the reader is referred to the many special reports that have been published by the United States Department of Agriculture, and which are described in the bibliography that will be found in the Appendix of this report.

The total value of the fresh and dried fruits imported into the United States during 1921 was $44,385,886, as against $68,326,274, representing the value of our exports of fresh and dried fruits during that year. The quantity and value of the principal imported fruits were: Bananas, 43,365,763 bunches, valued at $19,385,174; currants, 57,063,528 pounds, valued at $4,481,942; figs, 38,715,943 pounds, valued at $3,251,192; dates, 48,504,355 pounds, valued at $2,321,150; raisins, 16,879,933 pounds, valued at $2,422,765.

On the export side apples head the list with 1,936,224 barrels, valued at $13,981,865, exported in 1921, compared with 1,797,711 barrels, with a declared value of $14,088,733, exported in 1920. Other exports of fresh fruits in 1921 include 2,331,075 boxes of oranges, valued at $8,374,735; and 304,313 boxes of lemons valued at $1,295,923. Approximately, 55 per cent of the total value of our fruit exports in 1921 represented dried and preserved fruits, which consisted chiefly of dried prunes, raisins, apricots and dried apples. Of this amount, $9,280,298 represented the value of 117,933,740 pounds of dried prunes; $4,110,404, the value of 21,575,149 pounds of dried apricots; $5,516,806, the value of 32,968,664 pounds of raisins and other dried grapes; and $2,206,843, the value of 19,962,306 pounds of dried apples.

Export Markets for American Apples

Principal Foreign Markets

During the past decade varying quantities of apples, seldom exceeding 2,000,000 barrels, have been exported annually from the United States. The United Kingdom has always been the best customer and in 1921 took over 1,498,839 barrels. Canada is the next best customer, taking 166,410 barrels in 1921. Next in order was Norway, which took 80,233 barrels in 1921 and 67,434 barrels in 1920. Before the war Germany was the second largest importer of American apples. As soon as the rate of exchange and general economic conditions in that country reach a more stable level, Germany should again become an important market for American apples. Sweden and other North European countries consume American apples in lesser quantities. The Netherlands is normally a large apple exporting country and the demand for imported apples is therefore limited. When it is possible once more to resume business with Germany, Rotterdam will be in a position to distribute both box and barrel apples in considerable quantities to the Rhine provinces and to Southern Germany, which are only four and a half hours away by rail and nearer to Rotterdam than they are to Hamburg, Rotterdam's apple distributing rival. Rotterdam is also a distributing center for the Scandinavian countries.

Export Varieties and Preferences

The great bulk of the apples exported from the United States during the past few years have been prepared for shipment without much regard as to the special preferences and demands of the foreign customers. This has been true more particularly of barreled apples. To create a demand for his fruit the American exporter should therefore give special attention to the preferences in the several foreign markets. The need for grading and the importance of proper packing of apples are discussed elsewhere in this report.

The following varieties have proved generally satisfactory for the export trade:

Barreled	*Boxed*
Baldwins	Yellow Newtowns
Yellow Newtowns	Winesaps
York Imperials	Jonathans
Ben Davis	Spitzenbergs
Rhode Island Greenings	
Ganos	

Yellow Newtowns, York Imperials, and Baldwins have up to the present time been the favorite export varieties.

In England a certain preference is shown for the yellow varieties, while in the Scandinavian countries the red varieties command the best price; Baldwins, Kings and Ben Davis packed in barrels being special favorites. Practically no demand exists for green or cooking apples in Sweden. In the box packs, the varieties especially desired are Jonathans,

Spitzenbergs, Winesaps, and Arkansas Blacks. Rome Beautys and Yellow Newtowns are good sellers, but less popular than more highly colored varieties.

A strong preference exists throughout Scandinavia for the western box-pack. As business is transacted on a cash basis, it has been found more economical to deal in box apples than in barrel apples, and for this reason it is difficult to interest the trade in the direct handling of the latter. The preference for box-packed apples may also be attributed to the fact that they can be shipped more safely and are also more likely to arrive in a satisfactory condition. Boxed apples are furthermore better adapted to handling and inland transportation.

Packing and Grading

The importance of proper packing and grading and the sending of first-class fruit to foreign markets can not be over-emphasized. While packing and grading of fruit in the United States has greatly improved during recent years the change has not been so noticeable in the export trade. The demand for American apples has at times suffered considerably because of the large volume of "C" grade and jumble-pack stock that has been shipped to foreign markets. The old and so-called Slavonian-California pack was one of the worst packs that came into the London market. It always brought less than other packs, qualities being equal, because it was not trustworthy.

American exporters must therefore keep in mind that if they expect to develop and retain their hold on markets in foreign countries they must send sound fruit, properly packed and graded. The dumping of inferior fruit should be stopped. American apples in most foreign countries are a luxury and only good fruit is wanted. Strict export grading would be a great help for that would exclude much inferior stock. Such stock not only brings little more than the freight but depresses the price of better class fruit.

Recent reports from abroad indicate a general improvement in the condition of American fruit which arrived in the British markets during the past year. The fruit was well graded and a marked improvement was noted in the California pack. Boxed apples were much more in evidence on the British market during the 1921-22 season than during the previous years. As we have already pointed out, however, the box is a more popular container than the barrel in the British markets, although barreled apples have on some occasions brought higher prices than equal weights of boxed apples. In practically all of these cases the condition of the fruit was the determining factor. In England, a particularly heavy pack is desired. There is also a decided preference in most markets for apples wrapped in paper. In the British markets paper is a distinct mark of quality and where it is lacking the best prices can not be expected. In Germany, however, apples wrapped in paper are regarded as luxury fruit and the regulation against the wrapping of apples is merely a rough and ready method of distinguishing between low and high class fruit.

In order to insure the safe arrival of boxed apples on the other side,

the boxes should be securely wired or strapped. If the cases are made of slightly heavier material than the cases used in domestic shipments they will stand up much better under the trying conditions of transportation and handling on the steamship docks, vessels, and railroads on the other side.

Transportation and Freight Rates

Condition and quality are two important factors that determine the price of apples on the foreign market. Since so much depends upon the conditions under which apples are shipped and handled from the time they leave the orchard until they reach the foreign market, the need for proper care and handling in transit can not be emphasized too strongly. Although shipments made in ordinary stowage in the past have arrived in a satisfactory condition, shipments so made can not be expected to bring as good price as apples shipped in cooled air refrigeration. It is well, therefore, when apples are shipped on consignment to insist that shipments be made in this manner.

Ocean freight rates have been materially reduced during the past two years. The present rate (November 4, 1922) from the North Atlantic ports of the United States to the United Kingdom on barreled apples in ordinary stowage is $1.00 per barrel, while the rate on shipments in cooled air refrigeration is $1.50 per barrel. Two years ago these rates were $2.50 and $3.00 a barrel, respectively, or just about double the rates now in effect. The present ocean freight rate on boxed apples from the North Atlantic seaboard to the United Kingdom is 35 cents a box, in ordinary stowage, and 55 cents a box in cooled air refrigeration. These rates also show a marked reduction from those in effect two seasons ago when the rates where 60 and 75 cents a box respectively. Boxes must be strapped or wired, or guarantee given. The minimum bill of lading charge is $10. In other words, the rates given above apply only to shipments on which the total freight rate exceeds $10. The rate on boxed apples in refrigeration from the Pacific coast to the United Kingdom is $1 a box.

On shipments to Argentina the rate on barreled apples is 75 cents a cubic foot, while the rate on boxed apples is $1 a cubic foot. This would make the rate per barrel approximately $5.82, based on an allowance of 7.75 cubic feet of space for one barrel. On the basis of $1 a cubic foot on boxed apples the rate per box would be from $1.80 to $2.01, depending on the size of the box, which varies from 1.80 to 2.01 cubic feet. An average of these two is 1.90 cubic feet per box, or an average rate of $1.90 per box.

The shipment of fruit from Pacific coast ports to the United Kingdom, via the Panama canal, is a new development in fruit transportation and is made possible by expert methods of handling, packing, storage, and refrigeration. In spite of the long journey of more than 8,600 miles, a shipment of over 30,000 boxes showed less than 180 slight breakages. These breakages were so slight that they were easily remedied by putting in a few extra nails.

Method of Exporting Apples

Unless the grower has had some experience in foreign marketing and is in a position to make shipments regularly throughout the season he will probably find it to his advantage to ship his apples on consignment through some reliable export commission merchant in the United States. In the English market, as we have already seen, the general practice has grown up of shipping fruit to firms in that country who then dispose of and distribute it in the best and most advantageous method possible. In fact, this is the only way of transacting business with many foreign countries where the actual importers prefer to do business through resident agents on a commission basis. Once a grower has established his connections he can study the foreign price quotations which are received by cable from some of the European markets and as soon as he feels that he thoroughly understands all of the factors entering into foreign marketing, he can make a venture on his own account, provided he feels that he can get better returns that way.

At the present time many of the importers in the Scandinavian countries obtain their apples from the auctions in Great Britain and other nearby countries. Direct trade relations, therefore, between exporters in the United States and Scandinavian importers should prove mutually advantageous.

It may be well to point out in this connection that it is impossible to control sales at a distance of 3,000 miles from the market. The condition of the apples, as is so frequently the case, is a very important factor in the situation and the shipper must rely upon the judgment and integrity of the importer, always of course reserving the right of transferring his business if the results of a number of consecutive transactions prove unsatisfactory. Shippers who have their own representative in the foreign market must also allow his full power over sales. The man on the spot, if he is competent, is bound to know best and if he is incompetent it is useless to attempt to guide him from a distance. Spanish fruit exporters are practically all represented on the British markets and a number of their agents are present at every sale, where their influence is constantly manifested in the interests of their employers.

The method of handling American fruit for export needs reorganization, which must begin at home. There must be more complete and thorough organization and cooperation between the producer and his marketing agents. The legitimate needs of each market should be supplied and steps should be taken to prevent continued slumps such as have occurred in the British markets, the cost of which is always borne by the producer and the exporter. Exporters should be fully informed at all times concerning the movements of fruit and the probable demands of the markets to which fruits are being exported. There should be cooperation between fruit shipping agencies to avoid overstocking the market. No one gains anything when the market is flooded by a lot of fruit that rots before it can be consumed. Cooperative producing and marketing agencies may find it to their advantage to employ jointly agents at ports of embarkation and also agents in the principal foreign

markets. The Department of Agriculture can assist fruit exporters by furnishing them information regarding market conditions at foreign points and the inspection service of the department also may be used to standardize the grade and quality of fruit shipments destined for export.

Market Reporting Service

Prompt and reliable information regarding receipts in the various foreign markets, the prices at which American apples are selling and the general trend of supply and demand is just as important a factor in export marketing as in the sale of apples for the home market.

Most of the larger exporters receive such market reports direct from their own connections abroad. However, many of the smaller growers and exporters do not have this advantage. To meet the needs of these smaller growers and exporters and also as a check against reports received from various private sources, the United States Department of Agriculture has developed a special market reporting service for the principal markets in the United Kingdom, to which the bulk of American apples are shipped. One of the features of this service is a weekly cable report from the Agricultural Commissioner of the United States Department of Agriculture in London, giving the origin and price of the different varieties of American apples sold in the British market.

A more detailed review of the British apple market is also received each week by mail during the apple season. These reports are published regularly in "Weather, Crops and Markets," the official marketing publication of the United States Department of Agriculture. The price quotations received by cable are also included in the special weekly market review of the Fruits and Vegetables Division of the Bureau of Agricultural Economics, which is sent out from the Washington office by telegraph to the various district offices of that division.

Cooperation for Export

The successful marketing of fresh fruit for export demands a high degree of specialized training and knowledge of foreign markets and marketing methods. As specialists in production, growers have neither the time nor the personal contact with market conditions, both of which are essential to secure satisfactory results, to study the foreign markets and to look after the innumerable details which export marketing involves. Moreover, export marketing in order to be profitable must be conducted on a sufficiently large scale to provide a continuous supply of fruit to the foreign market through the season. It is obvious, therefore, that by cooperation the grower is in a position to do what he could never hope to do for himself in developing foreign markets for his products.

One of the most important results that can be attained through cooperation is the establishment of uniform grades, whereby all of the fruit grown by the members can be marketed according to clearly defined standards. Several cooperative organizations have conducted comprehensive foreign investigations for the purpose of ascertaining the trade demands and making reliable trade connections.

Cooperative organization is more highly developed in the west than elsewhere in the United States. More than 50 per cent of the apples and other deciduous fruits of the northwest and middle Rockies and the larger portion of California fruits are distributed and marketed by cooperative organizations of the growers. In the Middle Western, Southern and Eastern States many special products, such as strawberries, peaches, apples, grapes, onions, potatoes, and other vegetables are distributed cooperatively in a large way. There are individual organizations that do an annual business in the millions.

England Our Chief Market

England is our biggest and best market and should be intelligently cultivated. Some idea of the importance of the British market for American apples may be gained from our export statistics which show that of our total exports of apples in 1921, amounting to 1,936,224 barrels, the United Kingdom took 1,498,839 barrels, or 77.4 per cent. The British market presents many interesting features. Criticism is often made of British methods, but a study of the markets during the past three seasons indicates that much of the criticism was not justified. There is no essential difference in the character of the British and the American trade. In both countries there are many firms that can be trusted and unfortunately others that may be looked upon with suspicion.

The American apple season in Great Britain begins some time in the month of September, contingent upon the scarcity in the British market of home supplies and supplies from the continent of Europe, and ends around the beginning of April. Supplies from Australia and New Zealand then come upon the market in great quantities. At the most we have a season which runs for only six months and usually less, making it impracticable for American houses to handle their own stock in Great Britain.

One of the difficulties in connection with the exportation of apples to British markets is the decision as to what system to follow in regard to the necessary sales force for handling and disposing of the fruit on arrival in the United Kingdom. This question is aggravated by the fact that American apples on British markets have a season of but from four to six months during which to be marketed.

Method of Handling American Fruit

The practice has therefore been evolved of shipping American fruit to firms in the United Kingdom who then dispose of and distribute it in the best and most advantageous method possible. American apple exporters have found that the British auctions serve their purposes satisfactorily. The opinion has been expressed, however, that American enterprise and cooperation would not only greatly improve conditions and facilitate distribution but it would also bring about an increase in consumption.

One of the thoughts that the American fruit exporter must bear in mind when attempting to establish a market for his commodity in the United Kingdom is that by the time the fruit reaches the foreign port it

has passed through conditions that are very unfavorable to its keeping qualities. There has probably been a storage period in the northwest or in the east, or long railroad shipments, considerable handling in New York, an ocean trip during the roughest part of the year and finally considerable exposure to weather conditions while being handled in England. It is quite evident that all of these conditions militate against the keeping qualities of the fruit. The general experience in the markets of the United Kingdom has shown, therefore, that the best thing to do with American fruit is to place it on sale immediately upon arrival regardless of the condition of the market. Although fruit is frequently kept one or two weeks during a severe slump, the general opinion of the British trade is adverse to a longer period of storage.

Opposition to Re-Conditioning

There are no available cold storages in the United Kingdom for overseas fruit. Whenever apples are stored, they are stored in the ordinary cellars of the dealers. There is also a great disinclination on the part of the trade to recondition fruit. The general practice is to place the fruit on the market regardless of its condition. There are two reasons for this course of procedure. (1) The lack of space and the shortage and high cost of labor necessary to re-condition fruit. (2) The strong prejudice of the trade against re-conditioned fruit.

It is quite impossible to sell re-conditioned fruit to the trade in Great Britain. This experiment was tried with oranges but with poor results. In the case of apples, however, it is a prejudice that is somewhat unfounded. One of the leading fruit operators in Copenhagen makes a practice of re-conditioning fruit with much success. He has, of course, a large plant and the available space and labor to do the work. Moreover, there is no prejudice in the Scandinavian trade against the practice. In fact, re-conditioning when needed is quite general in the fruit trade of Scandinavian countries.

Knowledge of Market Essential

The factors which give rise to our main difficulties in the British market, however, are not so much the handling of fruit on its arrival as the quantities and regularity with which it comes forward. There is a great need of a more thorough knowledge of British supplies and market conditions. The practice has been common in the past of dumping surplus supplies from New York on the British markets regardless of the supplies on hand. This naturally leads to disastrous results. Whenever the New York and other Atlantic markets become overcrowded with fruit from the northwest and other growing centers, the supplies are at once dumped on the British markets. Rather than let the American market break, these heavy shipments are at once diverted to England, regardless of conditions in that market.

Shipments of this nature are usually made by speculators. Having been hurriedly loaded on the first available boat without careful examination to ascertain their keeping qualities, they arrive in British markets in every possible condition. Their arrival, of course, completely disar-

ranges the plans of local dealers who have been importing about what they considered the trade would be able to carry under normal conditions. The result is a slump all around and the flooding of the markets with cheap fruit. Regardless of what profits have been made on the New York markets, no one in England makes a profit except those who accept the fruit and handle it on commission. The local dealers, of course, always get their commission, but are forced to make returns that show little profit to the shipper and in turn to the producer. As long as the market is handled in this manner, shipping fruit to England is going to be a gamble, showing excellent profits at one time and huge losses at another.

This is the most important problem of the British markets and it must be solved in the United States. The history of the past years, last year excepted because during that year supplies were short, has been the history of successive slumps and shortages. The first shipments from the United States are usually welcomed and bring high prices because the British supplies are exhausted. Numerous shipments then follow so that the markets soon become glutted. The inevitable result is that prices at once fall. The losses experienced on subsequent shipments are sometimes very large. Exporting then stops for a period and in one or two weeks the market is practically bare. Prices then again reach high levels and exports are resumed with renewed vigor until the market is once more glutted. This again results in a slump and a shortage and so on ad infinitum.

Auctions Supply the British Apple Consuming Public

The British apple consuming public is supplied through the auctions and through importers who maintain wholesale houses where fruit is sold at private sale. It is not our purpose to discuss at length the question of the advantage or disadvantages of the sale of fruit by private sale and by auctions. Suffice it to say that conditions are such in Great Britain that there would be no American apple market except for the auctions. Heavy supplies are dumped on these auctions throughout the year by the American, Canadian, Australian, New Zealand and Tasmanian apple growers, by the Spanish and Jewish orange growers (naval oranges from the Holy Land, Jaffa, are a feature), and by the growers of mush fruits in Continental Europe. The British merchants look to the auction houses for their supplies the year round. When our turn comes and the English fruit is out of the way, we take our place and hold it until we give way to the Australians and Tasmanians when their crops are ready, around the beginning of April. There is little overlapping in the seasons, however, as the Australian crop arrives just as we are through.

Market Price of Apples Set by Auctions

The market price for apples in the United Kingdom set by the auctions and the operations and prices of any one auction are known to the operators on all of the other auctions. Thus a Liverpool auction firm will know at all times exactly what is going on at London and Glasgow. It must not, however, be inferred that the auction is a fool-proof arrange-

ment and that one is safe to pick out any firm and ship at random for sale on the auction.

As already noted, the trade in England is just like the trade at home—there are gilt-edge firms that have been in business, whose word is as good as their bond and who are really anxious to secure the largest possible return for the producer and shipper. They are, as in the United States, in the majority and one is perfectly safe in dealing with them. They know the markets and their advice is often much better than the advice that comes from commercial sources in the United States. They are on the ground and can see what is going on. Unfortunately, there are however other firms whose carelessness in picking samples for the auction, in putting the fruit up for sale when conditions of the market do not warrant it, in throwing the produce on any market so that they can pocket their commission, and even in making private sales at their own convenience, is often the cause of heavy losses. There is under the present system no way of checking these dishonest firms since they can easily say that the fruit arrived out of condition and that the prices obtained were due to that cause.

Again, fruit is quite often thrown on one market in a period of depression when it really should have been reconsigned to another. Thus the Glasgow market will be up and the London market down. The London dealer, however, will throw the produce on the London market at a low price and get his commission, rather than tranship and get a good price for the shipper in Glasgow and get no commission. The answer to complaints is that the goods were shipped to London and should be sold there. These are but a few of the conditions and practices of which American exporters have at times to complain. Although these things do not happen to the customers of reputable firms, they have happened in the past and may happen in the future to firms in the United States shipping to firms in the United Kingdom with whom they are unacquainted.

Handling of Fruit by Private Sale

While the auctions dispose of the greater part of the American apples, there are efficient and ably-handled houses that import for private sale. These houses have their customers throughout the country whom they supply throughout the season. These firms are regarded as being more safe than the auctions, for they handle only the best fruit and must stand behind all their sales. Some of these firms buy direct from the producers, but by far the greater tonnage is on the consignment basis. This is a very creditable method of disposing of fruit, especially of the finest qualities.

The prices obtained are based mostly on the auction prices. Better prices are often realized, however, due to the fact that the trade in the country is saved the inconvenience of a trip to London or to the other large market centers. There is another advantage in that the trade is always protected against loss through defective condition. It is not generally considered as good a method of disposing of fruit, however, and it is not nearly so efficient when it is a case of disposing of fruit that has gone slightly off condition in transit. In such cases the fruit is

generally handed over to the auctions. These houses, depending as they do on the high class country trade, want only the most carefully graded and packed fruit, and are the great steadying influence in the fruit trade. They must stand behind every case they send out and there is no element of chance in their business.

Like the auctions, these houses hold a definite position in the trade and progress without them would be impossible. They are particularly valuable to firms which have brands of especially choice fruit to export and who want to build up a steady trade year after year. These firms get to be known for the superiority of their pack and can be trusted to be the same year after year. Country and continental firms, who have often lost money by reason of inferior brands, get to know that certain houses carry superior brands, and patronize these houses in spite of the fact that their prices may be higher. This point has recently been exemplified by the action of two Scandinavian houses, one in Copenhagen and the other in Stockholm. A certain house in Hull had all the business of these two firms, who refused lower prices both in London and in New York because they felt sure of getting the brand of apples they wanted from their firm in Hull, since this firm always saw that the fruit was in good condition. This helps to eliminate loss by deterioration in transit across the Atlantic.

These houses are of course both good and bad, the good houses by far predominating. Care must be exercised, however, in the selection of the house with which the exporter deals. One can not too often repeat and insist on greater care in the selection of English agents by American exporters. The American Agricultural Commissioner in London has on several occasions in the past year been asked to look up firms to whom carload lots have been consigned, and has found that they had no plant at all—just a back room and a desk. They obtained consignments and threw them on the first auction handy. The dishonest dealer is the exception, however, and not the rule, and it is generally a man's own fault if he loses on his deals in the British markets.

There is practically no American supervision of the American trade in Europe after the fruit leaves New York. There is one firm established in London which makes a specialty of handling consignments in all the markets of the United Kingdom and the continent. Fruit consigned to this firm is placed in the market which the head of the firm considers the best at the time the fruit arrives. Thus, if the fruit arrives at Liverpool and the Glasgow market is higher than the Liverpool market, the fruit is reconsigned to Glasgow. Often the continental or Scandinavian markets are bare and the prices better, so the fruit is consigned to those markets. This firm also takes care that the samples are representative of the lots placed on the auctions and generally looks after the shipper's interest.

A sketch of the British markets would be incomplete without a word or two about the street peddler who on his barrow disposes of a very important part of the apple surplus and deals at times in first class fruit. He is present at all auctions and carries off the fruit that the big merchants will not take, and, when fruit is scarce, he is at times a competitor for the finer fruit of the storekeeper. He pays cash for his fruit, takes it

home and reconditions it, and, in the course of a few hours, has it on his barrow on sale on every street corner in the poorer parts of all the larger cities. The store trade looks to him for help when the market is glutted and they do not look in vain. His barrow, drawn either by himself and wife or by a diminutive donkey, is one of the ordinary sights of every English city.

The South American Market

Direct trade with South America may be said to have begun about twelve years ago. Prior to that time supplies had been secured principally from England and Australia, apples from the United States frequently going to these markets through the hands of English traders. Direct sales to South American markets were small in the first year and they were made subject to acceptance upon arrival, the shipper paying all freight and insurance charges and collecting through the medium of English banks by sight draft attached to the documents.

The shipments from New York direct to South America increased approximately 400 per cent in the first four years after direct trade began. No consignments were attempted without previous sale until the fall of 1913, when an exporter shipped 13,000 boxes to Buenos Aires via New York and, a little later, 9,000 boxes via the Straits of Magellan.

The largest quantity of apples shipped to Argentina during any one year was in 1917, when exports to that country from the United States amounted to 58,435 barrels, while the exports to Brazil during the same year amounted to 25,297 barrels. However, in 1921 the combined exports to these two countries amounted to only 23,589 barrels, less than half of the exports of these countries in 1920, when Argentina took 32,688 barrels and Brazil, 24,656 barrels. Several years ago a New York firm of distributors sent a representative to study the South American markets and make trade connections for direct handling. Several months were spent in South America, but the representative met with considerable difficulty in interesting the importors who, it appeared, were very well pleased with their trade connections in the United States. Contracts for the sale of limited quantities were eventually secured and agents appointed in Buenos Aires. Sales were arranged upon easy terms but when deliveries were made only part of the shipment was accepted, the balance being sold by the commission agent. After that regular consignments to these markets were made for the purpose of supplying the demand independently of the importers who formerly had controlled the handling of this commodity.

It is not known just what the future results of these experiments may be. It is thought by those who have had the longest experience with South American importers that these markets can be developed best by handling the business in a manner most acceptable to the dealers. Attention is called to the fact that the importers have been accustomed to supply their markets by placing orders judiciously and receiving only such stock as has been bought previously. The consignment of apples, therefore, is severely discouraged by them, and it would appear from the experience of the past two years that those shippers who have en-

deavored to secure this trade by over-stepping Latin customs have not been entirely successful in their ventures.

The ocean freight rate from New York to Argentina amounts to about $5.82 a barrel. The facilities for safe transportation have been greatly improved during recent years owing to the importation of fresh meat from Argentina. Refrigeration is necessary for meat transportation, and the cold chambers are well suited to the transportation of apples on the return journey. If trade in meat products between South America and the United States continues to increase, the facilities for handling large quantities of apples are expected so to improve that space will be sufficiently available to justify lower rates. When the cost of transportation and the usual trade margins are combined, it will be seen that the selling price of apples in South America of necessity must prohibit heavy consumption. If transportation facilities can be improved so as to decrease the rates and the risk of deterioration in transit, it is believed that trade margins may be decreased reasonably and that the result in price to the consumer will be such as to encourage a large increase in shipments.

In order to assure the safe transportation of apples to South America it is necessary that the fruit be carefully selected, graded, and packed by hand, special care being exercised to eliminate everything that can not be classed as "Fancy" or "Extra Fancy." The box package is preferred for the reason that the fruit arrives in much better condition than when packed in barrels. To illustrate the need of care in this respect, the experience of an eastern fruit growers' association may be given. Through its foreign agent the sale of several carloads was made to a South American importer at 12 shillings per barrel, delivered on board the steamer at New York City. Delivery was made and the money collected, but the future patronage of the buyer and probably the prospect of future sales in his market apparently have been lost, because the fruit was not properly graded and packed at the time it was shipped from the producing area. An investigation has shown that this fruit had been packed without inspection on the part of the organization and that the packing was done some days in advance of shipment. Only a few barrels in each lot were inspected when the fruit was loaded on the cars.

Imports of Foreign Fruits

The imports of foreign fresh fruits into the United States consist chiefly of bananas from Central and South America; pineapples from Cuba and the Straits Settlements; lemons from Italy, and grapes from Spain and Canada. The principal imports of dried fruits include currants and figs from Greece, raisins from Spain, and dates from Turkey and India.

Climate, soil and other natural conditions determine the localization of the various kinds of fruits grown in different parts of the world. On the other hand, seasonal differences, general economic conditions, and the personal preferences of the consumer are responsible to a large extent for the international trade in fruit. One or more of these factors will explain why in 1921 the United States imported 16,879,933

pounds of raisins, while at the same time our exports of raisins during that year amounted to 32,968,664 pounds—nearly double the amount of our imports. Nearly one-half the value of our total imports of fruit in 1921, amounting to $44,422,706, represented bananas and pineapples. Bananas are essentially a product of the Tropics and are not grown commercially in continental United States. The value of bananas and pineapples imported in 1921 was $19,385,174 and $1,592,803, respectively.

Much interest has recently been displayed in the increased importation of fresh fruit from Chile, Argentina, and Brazil. The fruit seasons of the countries south of the Equator are just the reverse of those in the United States, which has suggested the possibility of making shipments of fruits to this country at a season of the year when they would meet with no direct competition of their own kind in our markets. Grapes and peaches are the principal South American fruits for which it is hoped to find a market in the United States.

The first effort to ship Argentine grapes to the United States dates from 1911. The shipment made in that year, like many shipments in subsequent years, was more or less experimental in character. In 1921 the total imports of grapes from Argentina amounted to only 391 cubic feet. In 1922, however, during the five months' period, February to June, imports of grapes from Argentina amounted to 20,748 cubic feet. The imports from Chile during the three months, March, April and May, 1922, amounted to 21,520 cubic feet.

The Argentine shipments of fruits which arrived in February of this year consisted of 900 packages, comprising peaches, plums, and grapes and met with fairly good demand from the jobbing trade which purchased them in small lots at rather high prices. The peaches were in small boxes containing from 70 to 90 each, and the quality was only fair, the fruit showing very little color. They sold from $2.50 to $5.00 per box, according to size and quality. The grapes were of the Muscat variety, four boxes of uniform size being strapped together. The net weight of the contents was about 32 pounds, and they ranged from $7.00 to $8.00. The plums, a red variety, sold best, at a range of from $4.50 to $5.50, mostly $5.00, and were packed in the same size boxes as the peaches. Another shipment of five tons of fresh Argentine fruits, consisting of select grapes, peaches, plums, and melons from the Province of Mendoza, arrived at New York during the middle of March on the Steamship Aeolus.

The trial shipment of fruit from Chile which arrived in New York early in March, 1922, consisted of 13,400 boxes of peaches and about 180 boxes of Santa Claus melons. The peaches arrived generally in good condition although a little decay was in evidence due probably to the fact that they were not packed well and the motion of the ship caused bruising and skinning of the surfaces. They were of good size, ranging from 2½ to 2¾ inches in diameter. They were in different types of containers, the majority of them being in flat lug boxes containing 32 peaches. The package and contents weighed 12½ to 13 pounds. The packages were rather slack, about four to six more

peaches could have been packed in the boxes. They were wrapped in paper similar to the manner in which California peaches are wrapped. These sold in private sales from $1.25 to $2.00 per box. The melons were packed in slat crates containing from two to six, principally three melons each, and sold slowly from $4.50 to $5.00 per crate. Apparently there was very little variation in the temperature maintained during this shipment and the fruit on arrival indicated that considerable care was taken to see that no needless injury would take place.

There are still many problems that must be solved before South American countries can hope to export fruit to the United States on a large scale. The distance from our markets is one obstacle, but that can be readily overcome by improved methods of packing, shipping under refrigeration and the exercise of proper care in the handling of the fruit in transit. Improved ocean steamship service between South American ports and the United States with a lower scale of freight rates are also essential to make such export shipments to the United States a profitable undertaking for the South American grower.

FRUIT INVESTIGATIONS IN AGRICULTURAL EXPERIMENT STATIONS

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When the Secretary of the American Pomological Society wrote me requesting a paper to be presented at this meeting, he indicated that a subject showing what the experiment stations of the United States and Canada are doing to aid the fruit grower would be a very desirable topic. It was with some misgiving that I promised to review and report the experimental work in fruit growing, for to one who is at all in touch with experiment station activities it is clear that there is a vast amount of work under way which, if treated satisfactory, would fill a paper far longer than could be properly offered in such a program as this. As the material for the report was collected it was first found necessary to limit the discussion to projects having to do with fruit growing alone. Many experiment stations, through their horticultural departments, are doing a large amount of work with vegetable production, floriculture, landscape gardening, etc., all of which is interesting to the average horticulturist, but all of which must be omitted from this paper for lack of time. It was further found necessary to eliminate from the discussion all of the horticultural experimental work conducted by departments other than horticultural departments, as for instance, the spraying investigations carried on through the departments of entomology and plant pathology. Nearly all of the special investigations regarding insects and diseases are conducted in these departments. A great deal of the work dealing with soil fertility in orchards is conducted by the departments of soils or agricultural chemistry or bacteriology. In some cases the departments of botany, through their plant physiologists, are conducting very fundamental researches bearing on fruit crops. All of these are ignored in the present paper. It has further been found necessary to omit a discussion of the vast amount of work being accomplished by the United States Department of Agriculture through its several bureaus and offices. To review this work alone in anything like an adequate way would require all the time that I might have at my disposal. I can only say in passing that the United States Department of Agriculture is covering a tremendously wide field, and is collecting data that in many cases cannot be collected by individual experiment stations. I am thinking in this connection of their studies of cost of production of fruit and surveys of fruit districts over the United States. A close analysis of their work would show that the ramifications of the Department of Agriculture extend into the horticulture of every region and nearly every state in the Union and extend all the way from the establishment of a blueberry industry in New Jersey to a study of marketing problems of citrus fruit growers in California and involve questions of culture, nutrition, varieties, root stocks, fruit storage, and many others which lie within their province. Hence this paper covers in reality only a portion of the work of research men in the United States and Canada dealing with the problems of the fruit grower in these two countries.

In discussing the problems under investigation it has been necessary to group them into rather broad and inclusive divisions and to mention only the more outstanding features of the studies and results of studies in each group. In order to secure, as far as possible, the latest information from the several stations a circular letter was sent out, asking each horticulturist to report the work under way in his department. Over fifty replies to this letter were received from the stations in the United States and Canada and it is from these replies, together with available published information, that this report has been compiled.

Variety Tests

Nearly every experiment station is conducting some work on the study of varieties. This represents one of the oldest lines of experiment station activity. The value of variety tests for any given locality increases in inverse ratio to the development of the fruit industry in that region. That is, districts which would be represented by the states of the upper Mississippi Valley or by Canadian provinces of Manitoba, Saskatchewan and others have the most keen interest in the testing of hardy varieties to discover sorts that will be hardy enough to extend the fruit belt farther within their domains or to enable them to develop to a high degree the incipient commercial industry which has already been established. There are, however, many interesting and valuable tests of varieties which are being conducted in older established regions. The Ohio Experiment Station, for instance, has for a number of years been attempting to classify the varieties of currants. It is quite common knowledge that currant varieties are badly mixed and that their nomenclature is in serious need of correction. As a result of this long time study the Ohio station is now prepared, not only to publish a report correcting the nomenclature of varieties and a description of authentic sorts, but is also preparing to distribute propagating wood of varieties which it can certify are correctly named so that nurserymen may start afresh in the propagation of these sorts with the definite knowledge that they are dealing with the correct variety.

Another interesting development of the varietal studies is the result of the work of Dr. Shaw in Massachusetts. A careful study and analysis of characters in varieties as exhibited in the nursery has brought out the fact that many varieties of apples can be positively identified in the nursery row and in Massachusetts today as a result of a movement fostered by fruit growers and the experiment station nursery stock is being certified as being true to name, the certification being made official by means of a small metal tag attached through a small hole drilled in a branch of each tree sent out.

Fruit Breeding

One of the most striking and spectacular lines of investigation has to do with the breeding and development of new fruits and the improvement of existing varieties. No less than twenty experiment stations are definitely engaged in efforts along this line. Among those who are working most extensively are the Central Experimental Farm at Ottawa,

Canada, and its various affiliated stations throughout the Dominion, the Ontario station at Vineland, the New York Experiment Station at Geneva, the Illinois Experiment Station, the Iowa Experiment Station, the South Dakota Experiment Station and the Minnesota Experiment Station. At the last two named stations, where work has been under way for some time, a considerable amount of equipment in the shape of fruit breeding greenhouses and land for growing seedlings is available. As a result of the work in these two states alone two score of varieties of hardy fruits have been introduced into the upper Mississippi valley and fruits of improved sorts have been made available to the citizens of this region. Many of their productions have proven of such extreme hardiness that they are promising to be of value in the Canadian provinces. Tests of such fruits as the Latham raspberry and a few of the hybrid plums produced at the Minnesota Fruit Breeding Farm have shown that they possess enough of merit to make them promising varieties in older established fruit regions of the country. It is quite possible that the Triflora-Americana and Triflora-Nigra hybrid plums may supplant the Japanese plum in Southern and Eastern United States. The work of the Canadian fruit breeders outside of the provincial station at Vineland has resulted in the introduction of about thirty varieties of fruit, the value of which to Canadian fruit growers has been estimated at around $3,000,000. Resulting from the fruit breeding work of experiment stations there are now available to fruit growers apples of the McIntosh flavor extending throughout the entire apple season. The Elberta type of peach can be secured throughout the entire peach season. Blight resistant pears are practically assured as are also pears hardy enough to carry the pear belt some 250 or 300 miles northward in the upper Mississippi valley.

Closely associated with the production of new varieties is the study of bud and cion selection in an attempt to improve varieties by this means. Several stations have projects of this nature. In general, outside of citrus fruits, the attempt to improve varieties by bud selection has been unsuccessful. The only exception to this comes from the Central Experimental Farm at Ottawa, Canada, where they have taken production records of Wealthy trees for 21 years. They have been able to propagate successfully both high and low yielding strains of Wealthy apples from parent stock, the production record of which has been known for 21 years. There seems in this case to be a close connection between tree vigor and productiveness for the low yielding tree in the case of both parents and progeny are weak growing individuals.

A very interesting development along the same line comes from Maine, where after a careful study and analysis of a Ben Davis orchard, it was found that differences in yield could not be attributed to genetic differences among the trees, but rather to other factors, such as soil differences, influence of stock, etc. In connection with their studies they found that a small nursery tree produced ordinarily a small orchard tree and that the production of the tree in the orchard was in direct relation to its size, so that on the basis of this discovery they are recommending that growers plant only vigorous growing nursery trees.

A number of stations in connection with their fruit breeding work are attempting to establish on a scientific basis the method of inheritance of fruit characters. If this can be successfully accomplished, it will reduce fruit breeding to an exact science and will increase the efficiency of breeding operations many fold.

Fertilizer and Nutrition Experiments

About one-third of the experiment stations are seriously engaged in a study of the nutritional problems connected with orchards and small fruits. In addition to these stations, which have major projects dealing with this phase of the work, nearly all other stations are more or less casually studying the same or similar problems. Furthermore, they have been studying the questions of orchard fertility for the past quarter century and more. The question of nutrition has proven to be one of the most involved of the projects with which experiment stations are dealing and has resulted in a smaller amount of definite, conclusive knowledge in proportion to the energy and time put into it than has almost any other line of experimentation. A few things, however, stand out clearly.

First, in nearly every instance of malnutrition nitrogen is the limiting factor. That is to say, in practically all cases where the orchard plants indicate a lack of growth and vitality and unfruitfulness, the condition can usually be benefited by the application of some form of readily available nitrogen. It has been conclusively shown that orchards in sod frequently become devitalized and almost invariably these orchards respond to nitrogen treatment. As a result of experimentation in this line vast quantities of nitrogen fertilizers have been used, notably in the peach region of Maryland and Delaware, and in the great sod mulch apple region of southern Ohio, which from the very verge of extermination, was re-established as an important fruit region by the use of nitrogen fertilizers. The prune and apple growers of Oregon and nearby states rescued their starving orchards by utilizing the information secured by experiment stations and applying nitrogen treatments. In most cases the growers are following still further advices from their experiment station men, as a result of which they are now many of them to a large extent growing their own nitrogen through the use of leguminous cover crops.

Much has been done to clarify the question of nutrition by the work of Kraus and Kraybill at the Oregon Station. These workers demonstrated that the question of nutrition was linked closely, not only with soil treatment, but with pruning methods, spraying practices, and in fact any orchard practices which would influence the growth of the plant. Their conception of the theoretcial relationship within the tree of nitrates and carbohydrates has done much to aid in the understanding of nutritional problems.

Several stations at the present time are working on the question of the influence of one crop upon another when the two are grown in proximity. It is as yet too soon to prophesy whether or not the work of Pickering at the English Experiment Station at Woburn will be veri-

fied in America. Whatever the findings of American investigators may prove to be, it will be of tremendous importance to know whether the ill effects of grass upon fruit trees is caused from toxic poisoning or from some other condition.

Pruning Studies

About ten or twelve years ago a number of experiment stations began rather elaborate studies of the effect of pruning on the apple and other fruit trees. Up until that time much of the teaching and writing relative to pruning was based solely upon rather casual observation and investigations. The results of these experiments, as far as they have been published, show clearly the error of some of the earlier beliefs. Particularly did it appear that continuous heavy pruning did not stimulate growth, but on the contrary exerted a dwarfing effect. Such pruning also greatly retarded the bearing period in young trees. Summer pruning, contrary to the usual expectation, was shown not to increase fruitfulness, but on the contrary, did diminish tree vigor to an extent that made its practice a serious menace in many regions. As a result of the investigations to date there is a tendency among Pacific Coast fruit growers to practice "long pruning" in place of the former heading back and to quite an extent have they discarded summer pruning. Among eastern growers the former rather erratic heavy pruning has given place to a minimum amount of pruning on normal trees, heading back being practiced only during the first three or four years of a tree's life. In most regions some form of the modified central leader tree is displacing the former open-headed tree as far as apples are concerned. The grape industry of Iowa was almost entirely revolutionized through the pruning studies of the Iowa Experiment Station. Experiments in Minnesota have shown that pruning may be practiced at any time during the dormant season with equally satisfactory results.

Pollination and Sterility

It has long been recognized that some species of fruits are conspicuously self-sterile while others are more or less self-fertile. Recent work in such widely separated states as West Virginia, Maine, Minnesota, California and Oregon has shown very definitely that, even in species that are normally self-fertile, such as the peach and apricot, the yield is considerably increased by cross pollination and that, with the apple, which is only partially self-fertile, the matter of pollination is very important. In the case of the plum particularly, which is to a large degree self-sterile, provision for cross pollination is absolutely essential to the most successful production. It has been estimated that the pollination studies of the California station alone have added many millions of dollars annually to the income of California fruit growers. Oregon at the present time may succeed in establishing a filbert industry as a result of pollination and sterility studies on that plant. The value of the honey bee as a pollenizer has been especially demonstrated by work in California and West Virginia. Much work has yet to be done concerning the mutual affinity of fruit varieties but ex-

haustive technical studies of the processes of pollination and fertilization which are now under way promise results of inestimable value to the fruit industry of this country.

Propagation Studies

A surprisingly large number of experiment stations are working upon some problems connected with the propagation of fruit trees. These problems involve questions of suitable stock for various varieties, relationship between stock and cion, germination of fruit seeds, proper age for orchard planting and similar questions. The solution of these problems will be of equal interest to nurserymen and fruit grower. Considerable interest is displayed in the question of securing root stock which may be propagated by cuttings, layerage, or some other asexual means to insure this uniformity.

With uniform roots and with the knowledge of varieties which succeed best on certain root stocks, there is likelihood of a considerable improvement in the uniformity of the behavior of individual trees in an orchard. The northern districts are especially interested in and are devoting considerable attention to the development of hardier stocks than are at present obtainable, in some cases making use of cion rooted trees to accomplish this end.

Winter-Killing and Hardiness Studies

The study of hardiness is not one which interests alone the northern experiment stations but on the contrary is almost equally important in such states as Missouri, New York and Minnesota, although somewhat different phases of the same general problems are involved in each case. At least eight or more important stations of the continent are engaged in the study of this problem. Without going into details it is sufficient to say that the problem is one that involves many difficulties and that, with a few exceptions so far, the experiments have not progressed far enough to warrant many general deductions and conclusions of immediate practical value. It has, however, been amply demonstrated at the Canadian Central Experimental Farm and at the Minnesota Experiment Station that topgrafting with tender varieties on hardy stock is of no avail and that the tender cion growth is readily killed back as far as the union with the hardy stock. Involved in the general question of hardiness is the question of breeding to secure hardier varieties, which in turn involves a study of the inheritability of hardiness as a character. It also involves the question of the production of late blooming varieties or varieties which maintain a dormant condition more tenaciously than present sorts. It apparently involves the question of nutrition as both the Missouri and the Massachusetts stations have some evidences to indicate that this is the case.

Spraying

A few horticultural departments are engaged in a study of spraying problems, but in far the greater number of states the responsibility of this line of investigation is delegated to other departments. However,

the contributions of the horticultural departments of Illinois, Iowa, Indiana and others have been of great value in working out satisfactory orchard practices. In a few cases a study of the control of special diseases and insect pests have been made through horticultural departments. As instances, at the present time California is engaged in a very extensive study of fire blight control involving a large number of treatments. Cornell is studying the causes of such obscure diseases as "water core" and "bitter pit." Indiana is working on "apple blotch" control and in Iowa the study of "crown gall" and its control in nurseries is being successfully worked upon by the horticultural department. In the latter case they report a reduction of crown gall in nursery rows of 15 to 20 per cent by dipping the grafts in bordeaux.

The Development of New Fruit Industries

The experiment stations of several states are figuring conspicuously in attempts to develop new fruit industries. Prominent among these is the work of the Georgia Experiment Station in the introduction and naturalization of the 'fig wasp', which is necessary for the successful production of high grade figs. Massachusetts is attempting the improvement of the highbush cranberry. Minnesota is attempting to domesticate the native blueberry, and add this fruit to the list of cultivated northern species. Closely connected with this type of work is the introduction of new varieties from foreign countries. While this is largely a federal project, it is also being carried on to a lesser degree by individual states and provinces, particularly those that are interested in the development of hardy varieties.

Small Fruit Problems

Small fruit culture is common throughout the United States and Canada, but the amount of research work which has been devoted to small fruits is comparatively small as compared to that which has been given to tree fruits. Nearly every experiment station is more or less casually working with small fruits, at least to the extent of carrying on variety studies, but only a few are paying especial attention to problems of nutrition, pruning and cultural systems. There would seem to be an especially promising field for investigators in this line. Until a strawberry has been developed which will compare favorably in its spring crop with any variety now in existence and then will go ahead and produce a fall crop of equal value, there is plenty of work for small fruit breeders.

Orchard Economics

Some stations have contributed greatly to our knowledge of the fruit business through their studies of the cost of production of various fruits. Prominent among these is the New York Experiment Station at Geneva, the Iowa and Minnesota Experiment Stations. It has been felt by many growers that cultural problems are rapidly becoming less important than those dealing with the economic handling and marketing of their products. The studies which these stations and the Department of Agriculture have made bear on the cost of production. Closely related to

these studies have been a large number of orchard surveys made by various states which have dealt not only with the study of incomes but also with the study of methods under which the fruit has been produced.

Nut Culture

About half a dozen stations are investigating some phases of nucicultural problems. In the southern states the pecan and Persian walnut have been particularly studied. Questions of the effect of fertilizers on the yield and development of a kernel in pecans are under way in Mississippi, while in North Carolina the whole question of soil adaptability of pecans, together with yield studies of individual trees, have been under way for 16 years. In Minnesota an effort is being made to introduce the black walnut and hickory nut to regions north of their natural range and an attempt is also being made to secure through hybridization a satisfactory hardy type of English walnut.

Harvesting and Storage Problems

At least six stations are carrying on more or less elaborate investigations into the cold storage of fruits. Iowa, with a fine equipment of cold storage chambers, has studied the development of scald, Jonathan spot, etc., under storage conditions and finds that the Jonathan spot can be greatly reduced by harvesting and storing the fruit at an early stage of maturity. At Cornell the physiological changes which fruit undergoes during its period of storage are being studied. In Washington the relation between the conditions under which fruit is grown and its keeping quality in storage have been studied for a number of years. It has been found that soil moisture has little effect and summer temperatures, whether low or high, are of little importance. Size of the individual fruits, however, does have a bearing on the problem, the larger fruits being the first to break down. In California and Oregon the question of ripening of the pear and plum under storage conditions have been carefully studied, with the result that in Oregon they have been able to determine the correct time for harvesting pears by a mechanical pressure test and the Californians have carried their studies so far that they are now able to ripen both the pear and plum so naturally in storage that, as they themselves admit, they can carry the "California flavor" over the mountains.

Fruit Thinning

Thinning of fruits on overladen trees has been studied for some time. Only a few stations are now actively engaged in this study, but recent work has clearly shown that thinning a crop is of great value in the development of the present crop and has no value whatever in its influence on a succeeding crop. Annual bearing cannot be secured through thinning.

Fruit Bud Formation

Closely associated with the thinning studies are those relating to the formation of fruit buds. The conditions governing fruit buds and their

response to various treatments is being studied in several states. It has been shown by work in Wisconsin, Iowa, New Hampshire and West Virginia and other places that the formation of fruit buds is directly related to the whole question of tree growth and nutrition. The Wisconsin station has been able to so diagnose the condition of their trees through a study of spur and twig growth that they have gone far in an effort to procure uniform annual setting of fruit buds.

By-Products

Only a few experiment stations are equipped to make a study of the manufactured products of the orchard. Prominent among these is Oregon. With a well equipped by-products laboratory which has been in operation but a comparatively short time, they have developed a new method of dehydration of fruits and vegetables. This process, which involves a readjustment of the relative humidity, temperature and air movement has speeded up the processes so that prunes may be dried in half the former time at two-thirds the expense and a product of much improved quality has resulted.

Technical Studies

A number of horticultural departments have included in their corps of workers highly trained, technical men, such as plant physiologists, ecologists, morphologists, bacteriologists and chemists. These men, some of whom have little or no horticultural background in their training, working together with the horticulturists, are making a number of purely technical studies which perhaps are of little practical value to the fruit grower and yet which are driving at the solution of fundamental problems which must be worked out before some of the practical problems can be carried much nearer to solution than they are at present.

This leads to a concluding statement which I am moved to make after a careful study of the work which has already been discussed. One is impressed after such a study with the fact that the development of fruit growing today has reached a point where its problems are far more difficult than they were a quarter of a century ago and the solution of these problems is consequently more difficult and usually calls for a more highly trained investigator and for longer periods of time in carrying an investigation to a conclusion.

Be not impatient if somewhat critical problems in your state seem to be slowly dealt with. Few indeed are the problems that can be solved in a season, or even satisfactorily worked out in two or three seasons, while many are the problems which require a decade of time to mark definite steps of progress or to reach conclusions. The only feeling that one can have, after an intelligent study of the progress that has been made by horticultural research men in the past 25 years, is one of wonder that the problems have been solved as rapidly as they have been and that, with comparatively meager financial backing, they have been able to make the progress they have.

REPORT OF THE COMMITTEE ON WILDER MEDALS

The Committee on Wilder medals has made the following awards:

To the Iowa State College a silver medal for the splendid exhibit of seedling apples of known parentage.

To the Washington Nursery Company, Toppenish, Washington, a silver medal for the exhibit of Rainier apples.

To the New Hampshire State Horticultural Society a bronze medal for an unusually fine exhibit of apples.

To the North Carolina Agricultural Experiment Station and Extension Service, a bronze medal for a very attractive exhibit of high grade apples and pecans.

To the Nova Scotia Experiment Station, a bronze medal for a remarkably instructive exhibit of more than one hundred varieties of apples.

To the George C. Roeding Company, Niles, California, honorable mention for a fine exhibit of Persian walnuts, chestnuts, almonds, filberts, pears and dried prunes.

To the office of Seed and Plant Introduction of the United States Department of Agriculture, honorable mention for a good display of persimmons, pomegranates, quinces, jujubes, feyoas, pistachios, almonds, chestnuts and haws.

The committee did not feel justified in taking any action on the so-called Coates 1418 prune which has not yet been given a real name, but is being sold under two or more temporary names by western nurserymen. This prune has real merit and no doubt will be entered again for Wilder medal next year.

Action was also not taken on the so-called Red Northern Spy apple.

C. P. Close,
C. I. Lewis,
L. Greene,
Committee.

AMERICAN POMOLOGICAL SOCIETY'S COMMITTEE ON RESOLUTIONS

The American Pomological Society in regular session at Council Bluffs, Iowa, wishes to express its appreciation of the hearty cooperation, the accommodations and the entertainment afforded for this annual session of our organization to the officers of the Mid-West Horticultural Exposition, the State Horticultural Society and affiliated organizations, and especially to Prof. R. H. Herrick for his untiring efforts which contributed so largely to the success of this meeting.

We also herewith express our appreciation for the work which has been done and the opportunities afforded for the expansion of American Pomology through the efforts of the Federated Fruit and Vegetable Growers' Association, incorporated.

Your committee regrets having to report the death of four of its members and active supporters, Dr. J. C. Whitten and Mr. G. Harold Powell of California, Prof. S. A. Beach of Iowa, and Prof. J. P. Stewart of Pennsylvania. By the loss of these four men of national and international reputation in the field of horticulture and especially in that of pomology, there is left a gap in our ranks which can never be filled. These men were not only authorities in their respective fields and their scientific papers greatly valued by us, but it was through the inspiration and kindly help of such men that this society finally took hold of the big problems of developing pomology to its present high state of perfection. Your committee, therefore, recommends that the secretary of this society convey to the immediate family of these departed friends our deep sympathy and high appreciation for the work which they have done in their respective fields.

Signed by your committee,

J. C. Blair,
Frederic Cranefield,
H. L. Lantz.

REPORT OF COMMITTEE ON SLOGAN

Your committee on a "fruit slogan" submits the following progress report.

The adoption of a slogan is of sufficient importance to warrant careful deliberation, and consequently we do not feel at this time enough progress has been made to justify the adoption of any of the suggestions. There are two things to consider; first, shall the slogan represent the fruit industry collectively, and secondly, shall it be representative of the deciduous fruits. If only the latter, a slogan might refer to our representative fruit which is procurable throughout the 365 days in the year in fresh form, namely, apples.

The following suggestions have been made which might be considered. A great many others have been suggested which are not incorporated in this report, because of lack of merit.

"If You Would Be Well, Eat Fruit."
"Let No Day Be Fruitless."
"Measure Life by Its Fruits."
"Health Is a Fruit Product."
"Fruit Is Health."
"Fruit Is the Health Food."
"If You Like Health, Eat Fruit."
"Eat Fruit Daily—It's the Cheapest Health Insurance."
"Health's Best Way—Eat Apples Every Day."
"Nature's Own Medicine—Pleasant to Take."
"Buy a Barrel of Apples."
"Apples Are Loaded With Sunshine."
"Eat Fruit."
"Use It With Fruit."

"Give It With Fruit."
"Do It With Fruit."
"Eat More Fruit."
"Fruit for Health."
"If You Would Be Well, Eat Fruit."
Moved that the committee be given further time. Carried.

REPORT OF COMMITTEE ON NEW FRUITS FOR 1922

C. P. Close, Chairman

The same plan of assembling and reporting on fruit varieties is being followed in this report as in the reports for 1920 and 1921 to which the reader is referred. Some of the varieties listed are not strictly new, but they are included in order to complete a check list of all varieties ever introduced into American fruit growing. Miss Magdalene R. Newman of the United States Department of Agriculture has again rendered most valuable aid in assembling this information.

The chairman wishes it understood that he is reporting the names and descriptions of varieties just as they come to him without changes and without any recommendations. Some of the names will need to be revised to comply with the St. Louis Code of Nomenclature which the society has adopted as official.

APPLES

Adel (Ames 419): Unknown parentage. Originated by the Iowa Experiment Station. Fruit medium size, greenish yellow or yellow striped and mottled with lively red, resembles Gravenstein; flesh crisp, very juicy, tender, sprightly subacid, pleasant, good to very good; October to January. Tree vigorous, productive.

Afton (Ames 459): Wolf River x Harrington. Originated by the Iowa Experiment Station. Fruit good size, attractive, bright red, symmetrical, flesh fine grained, tender, pleasant, sprightly subacid, good. Tree vigorous, upright to spreading, productive.

Ames (Ames 480): Allen Choice x Perry Russet. Originated by the Iowa Experiment Station. Fruit good commercial size, roundish-oblate, smooth, often broadly ribbed; skin dark red, sometimes entirely covered with solid dark red; flesh very firm, yellowish, crisp, moderately juicy, sprightly subacid, good to very good. Keeps until April or May or later. Tree upright spreading, vigorous, appears to be an annual cropper.

Ascot: "Originated by Archer S. Davis, New York. First fruited 1919. Fruit resembles Lady Blush, is the size of Greening, has a tart, pleasant flavor like Winter Banana and is a good keeper."—American Fruit Grower; March, 1922.

Bingo: Jewell Nursery Co., Lake City, Minn. "Hardy in central Minnesota. Fruit large, color green streaked with red; excellent quality; stem short and thick; fruit hangs to the tree in a remarkable manner. Keeps until April."

Boomer: Noble Nursery, Noble, Okla. Not described.

Chattahootchee Greening: Fruits furnished by E. R. Minhinette, Cove Springs, Georgia, in December, 1917. Originated on the banks of the Chattahootchee River. Fruit small to medium, round-conic to short cylindrical-conic; pale yellow with very thin pink blush; dots small, numerous, some indented, russet green or pink; stem

one inch long, slender; cavity small, abrupt, russeted, moderately deep; basin narrow, shallow, wrinkled; calyx very small, lobes small; flesh tinged yellow, rather tough, crisp, coarse, moderately juicy, mild but rather rich subacid, fairly good; core medium size, long conic; seeds medium, plump.

Colville: Brought from Paris, France, by H. M. Gilbert, Yakima, Washington. Fruit said to be large, yellow; flavor spicy; good keeper, until May in common storage. The Fruitman's Guide, September 9, 1922.

Earlham (Ames 475): Colorado Orange x Allen Choice. Originated by the Iowa Experiment station. Fruit large, yellowish green, often with pink blush; flesh firm, rather tough, moderately juicy, nearly sweet. Tree vigorous. Subject to bitter pit.

Edgewood (Ames 479): Salome x Jonathan. Originated by the Iowa Experiment Station. Fruit larger than Jonathan, but of about the same color, flavor and much the same quality; keeps to March or April. Tree vigorous.

Haralson (Minn., No. 90): Malinda seedling. Originated by the Minnesota Experiment Station. "An early bearing variety with a tree of moderate size, vigorous, upright in growth, hardy; fruit medium to large in size, roundish to slightly flattened, well colored, with an even red over the entire surface; flesh fine-grained, tender, juicy, subacid; quality good. Keeps in common storage until early spring."

Hawkeye Greening (Ames 414): Vermont Seedling. Originated by the Iowa Experiment Station. Fruit large, yellow or greenish yellow; flesh fine grained, juicy, tender, sprightly subacid, good to very good for dessert or culinary use; October to March. Tree vigorous, productive, apparently hardy.

Idella: Originated with O. L. Henry & Son, Pennsburg, Montgomery County, Pennsylvania, in 1912. First fruited in 1917 and was introduced by O. L. Henry & Son in 1922. Fruit medium to large, shaped like Delicious without knobs; yellow with many red stripes; flesh yellowish, very juicy, aromatic, subacid, good. Season same as Wealthy. Said to be extremely hardy and an annual bearer.

Knepper: Leonard Coates Nursery Company, Morganhill, Cal. A seedling originating near San Martin, Santa Clara County, California. Fruit very large, roundish conic, irregular; color waxen yellow; flesh very firm, crisp; season late winter.

Lawfam: Seedling of Lawver x Fameuse, originated by the Central Experimental Farm, Ottawa, Canada, and named in 1921. Fruit medium size, roundish to oblate-conic; cavity open, medium depth, russeted at base; stem medium length, moderately stout; basin medium depth and width, wrinkled; calyx open; color yellow, washed with deep attractive crimson, dots obscure, flesh yellowish tinted red, crisp, moderately juicy, subacid, pleasant, good; core medium to small, open; season late December to March.

Lobo: Seedling of McIntosh, originated by the Central Experimental Farm, Ottawa, Canada. Fruit above medium, roundish-conic; cavity medium depth, open, sometimes russeted; stem short to medium, stout; basin deep, narrow, almost smooth; calyx open; skin thick, tough, pale yellow, almost white, washed with bright crimson; dots gray, indistinct; bloom little if any; flesh white with traces of red, fine grained, tender, juicy, subacid, sprightly, pleasant, good; season October. (Description first published in 1910.)

Lowbeth: Seedling of Liveland x Bethel, originated by the Central Experimental Farm, Ottawa, Canada, and named in 1921. Fruit medium size or above, roundish-conic, red; cavity open, medium depth, wrinkled; stem medium to long, moderately stout; basin medium depth, medium width, wrinkled; calyx closed, skin mod-

erately thick, tender, pale yellow, washed and splashed with orange red; dots obscure or russeted; flesh dull white, faintly tinged red, tender, juicy, subacid, pleasant, good; core large, open; season mid-August to October. Attractive in appearance and as good as or better than Liveland.

Mason (Ames 474): Northwestern Greening x Wealthy. Originated by the Iowa Experiment Station. Fruit large, handsome, pale green or yellow, blushed and mottled with red; flesh pleasant, sprightly subacid about like Wealthy; October to January. Tree vigorous, upright-spreading, very productive.

Maud (Ames 487): McIntosh x Longfield. Originated by the Iowa Experiment Station. Fruit larger than Red June, very attractive bright red, follows Red June in season; flesh white, tender, juicy, sprightly pleasant subacid. Tree vigorous, healthy, productive.

Miltosh: Seedling of Milwaukee x McIntosh, originated by the Central Experimental Farm, Ottawa, Canada, named in 1921. Fruit medium or above, roundish, slightly ribbed; cavity narrow, medium depth; stem short, stout; basin open, medium depth; to deep, wrinkled; calyx partly open; skin moderately thick, moderately tough, yellow washed and splashed with crimson; flesh dull white or yellowish, firm, crisp, juicy, subacid, pleasant, quality medium to good. Season December to March or later. Resembles Fameuse considerably in shape and color.

Monona (Ames 473): Wolf River x Harrington. Originated by the Iowa Experiment Station. Fruit large, red, attractive; flesh tender, smooth, juicy, pleasant mild subacid, somewhat perfumed, good to very good. Tree vigorous, productive, holds fruit well.

Napoleon: Seedling of Northern Spy. Originated by the Central Experimental Farm, Ottawa, Canada. Fruit medium size, roundish; predominant color crimson; flesh yellowish, crisp, juicy; flavor briskly subacid, pleasant; quality good; season December to late winter. Resembles Northern Spy somewhat in flesh and flavor.

Ohio Beauty: Woodlawn Nurseries, Rochester, N. Y. Fruit very large, roundish-oblong; skin smooth, yellow, blushed and striped with red; flesh tinged with yellow, crisp, tender, aromatic, juicy, subacid, fine for dessert and cooking. December to April.

Oklahoma Keeper: Noble Nursery, Noble, Okla. Not described.

River's Peach: Leonard Coates Nursery Company, Morganhill, California. "Very fine dessert apple, midseason."

Rosalie: Seedling of Northern Spy. Originated by the Central Experimental Farm, Ottawa, Canada. Fruit above medium to large, roundish-conical; predominant color crimson; flesh yellowish with traces of red, tender, moderately juicy; flavor subacid, sprightly, spicy, pleasant; quality good; December to late winter. Resembles Northern Spy considerably in outward appearance, flesh and flavor.

Secor (Ames 445): Salome x Jonathan. Originated by the Iowa Experiment Station. Fruit medium size; uniform, smooth, bright red, attractive; flesh crisp, juicy, rich subacid, very good quality; January to March. Tree vigorous.

Sharon (Ames 472): McIntosh x Longfield. Originated by the Iowa Experiment Station. Fruit attractive, red striped; flesh rich, aromatic, mild subacid, very good; September to midwinter or later. Tree productive, healthy.

Sparts: Seedling of Northern Spy. Originated by the Central Experimental Farm, Ottawa, Canada. Fruit medium to large, roundish to oblate; predominant color crimson; flesh yellowish with traces of red, crisp, tender juicy; flavor subacid, pleasant; quality good; November to middle of February or later. Resembles Northern Spy a little in outward appearance, flesh and flavor.

Winter Blush: Seedling of Northern Spy. Originated by the Central Experimental Farm, Ottawa, Canada. Fruit above medium size,

roundish; predominant color dull carmine; flesh white, crisp, tender, juicy; flavor subacid, sprightly, spicy, pleasant; quality good; season late November probably through the winter. Somewhat like Northern Spy in character of flesh and flavor.

CRAB APPLE

Hardin: Jewell Nursery Co., Lake City, Minn. "November; large; green tinged with red; subacid, good quality."

Kola: Originated by N. E. Hansen, Brookings, S. D. Hybrid of a native Minnesota crab with Oldenburg. Fruit 2 inches in diameter, flat, green. Fruit cooks up into an acceptable sauce.

Linda Sweet: Originated by N. E. Hansen, Brookings, S. D. Seedling of Malinda probably by Sweet Russet crab. Fruit large, much russeted, mild subacid, sweet, apparently a late winter variety.

Lora: Seedling of Progress. Originated by the Central Experimental Farm, Ottawa, Canada. "Fruit crab-like but rather large for a crab."

Maga: Seedling of McIntosh probably by Virginia crab. Originated by N. E. Hansen, Brookings, S. D. Fruit large, flattened, bright red stripes; flesh of same type as McIntosh; season evidently late.

Printosh: Prince x McIntosh. Originated by the Central Experimental Farm, Ottawa, Canada. "Rather large; good flavor."

Rosilda: Prince x McIntosh. Originated by the Central Experimental Farm, Ottawa, Canada. Resembles McIntosh in color, though brighter, large.

Shoko: Originated by N. E. Hansen, Brookings, S. D. Hybrid of a native Minnesota crab with Alexander. Fruit nearly 2 inches in diameter, green, acid, cooks into acceptable sauce.

Tipi: Originated by N. E. Hansen, Brookings, S. D. Hybrid of a native Minnesota crab with Oldenburg. Fruit and tree resemble Kolo crab.

Zapta: Originated by N. E. Hansen, Brookings, S. D. Hybrid of a native Minnesota crab with Bismarck. Fruit 2⅛ inches in diameter, green, acid and acerb, cooks into sauce readily.

PEAR

Cayuga: Seedling of Seckel, originated by the Agricultural Experiment Station, Geneva, N. Y. Fruit nearly as large as Bartlett, greenish yellow with blush; quality very good; season last of September.

Chamness: The Clingman Nursery, Keithville, La. "The fruit is of medium size, beautiful golden yellow, smooth, well shaped and ripens thoroughly to the core, flesh melting and juicy, tender and sweet. Ripens last of August. Said to be superior to Kieffer and tree resembles Kieffer."

Chinese Imperial: Tribble Nurseries, Lodi, Cal. "Very rare; from Imperial Gardens of Pekin, China. Good size, sweet, sugary and very fragrant."

Climax: Clingman Nursery, Keithville, La. "Very large, rather round, good flavor, flesh brittle, valuable. August."

Fragrant Chinese: Tribble Nurseries, Lodi, Cal. "Medium and with a peculiar, delicious flavor. Very fragrant. Used by Chinese to perfume their houses. Tree very large. September."

Mendel: Originated by W. Pfaender, Jr., New Ulm, Minn. "The fruit is as large as or larger than Bartlett, golden yellow in color when fully ripe, and good flavor. Claimed to be especially adapted for the Northwest. It has proven itself blight proof when named varieties standing near have died from blight." National Nurseryman, May, 1922, page 140.

Pineapple: The original tree in this country is said to have been brought as a rooted tree from China in the fifties by an officer in Commander Perry's fleet. This tree is said to be still living in

South Carolina. It has produced as much as 100 bushels of fruit in one crop and is about 3 feet in diameter. Fruit medium to large, resembles Kieffer in color and shape, is fine for canning, preserving and for marmalades. Supposed to be practically blight proof. The Florida Grower, November 25, 1922.

San Juan: Leonard Coates Nursery Co., Morganhill, Cal. Not described.

Southern Hybrid: Clingman Nursery, Keithville, La. "Large, melting, rich, juicy; tree vigorous, productive. September."

Southland: Griffing Nurseries, Beaumont. Texas. "An excellent preserving or canning pear. As an eating pear it is fine when fruit is picked when nearly full grown and ripened in a cool, dark place."

Tangli (S. P. I. No. 55550): From Talifu, Yunnan, China. Fruit oblong, russet-brown, slightly acid, but sometimes sweet; it is better cooked than fresh. Ripens from April to August in China.

Wu pa li (S. P. I. No. 55497): From vicinity of Talifu, Yunnan, China. Fruit very large, skin thin, light yellow with red hue; flesh yellow, edible.

QUINCE

Antiquera: Tribble Nurseries, Lodi, Cal. "Recently introduced from Granada, Spain. The finest of quinces; pure yellow; medium size, melting and exquisite flavor. August."

Prolific: Allegan Nursery, Allegan, Mich. Not described.

PEACHES

Adams Cling: Tribble Nurseries, Lodi, Cal. "There is no cling better than this new variety originating near Acampo. Very large. clear yellow to pit; extra firm, round, sweet and fine flavor. August and September."

Barry (of Arkansas): A chance seedling originating with W. T. Barry, Fayetteville, Ark. "A large white peach with red blush similar to the Chinese Cling, and we think a better bearer and equal to if not better in flavor." Arkansas Nursery Company, Fayetteville, Ark.

Dainty: Leonard Coates Nursery Company, Morganhill, Cal. Not described.

Early Columbia: Fancher Creek Nurseries, Fresno. Cal. Introduced in Oregon. Large; skin white and blushed; flesh white. Valuable for shipping. Early May.

Fair's Beauty: Texas Pecan Nursery, Arp, Texas. Said to ripen 20 to 30 days earlier than Elberta. Fruit large, yellow with beautiful red cheeks; stone semi-cling.

Fei: Leonard Coates Nursery Company, Morganhill, Cal. Not described.

Goodman's Choice (S. P. I. No. 55549): From Eastwood, New South Wales. Fruit said to be medium size, yellow with rich red blush; flesh yellow, excellent for canning, clingstone. Tree productive.

Hartley: The Cumberland Nurseries, Winchester, Tenn. Not described.

Henderson's Extra Early: LaFayette Nursery, LaFayette, Ga. Said to be earlier than Mayflower, though not so highly colored but better in quality. Fruit medium size, cream colored splashed with red; freestone.

Kirkman's Early: Tribble Nurseries. Elk Grove, Cal. Clingstone. Not described.

Late Champion (S. P. I. No. 43129): From Auckland, New Zealand. Fruit very pretty, almost red, flavor very agreeable; freestone. Season May in Alabama.

May: Tribble Nursery, Elk Grove, Cal. Semi-cling. Not described.

Mammoth White Heath: Tribble Nurseries, Lodi, Cal. "One-third larger than the White Heath. Skin creamy yellow, covered with a rich blush; flesh clear white to pit. September."

Money Maker: Foster Nurseries, Denton. Texas. "Large, deep red and orange; flesh red; cling. September 1."

Mowry's Strawberry Cling: Fancher-Creek Nursery Co., Fresno, Cal. "Large, yellowish white splashed with red; flesh firm, flavor excellent. A splendid shipper and a particularly fine home canning sort. September."

Murphy: Durant Nursery Company, Durant, Okla. "Clean, yellow. September."

Osprey Improved (S. P. I. No. 43134): From Avondale, Auckland, New Zealand. Fruit large, greenish with bright red check; flesh soft, flavor delicious. Freestone.

Pomona Improved (S. P. I. No. 55487): From San Diego, Chile. Fruit very large, deep yellow, clingstone, excellent for canning.

Red King: Champion Nurseries, Perry, Ohio. Fruit medium to large, deep red; flesh deep red, quality excellent, said to be fine for preserving and canning. Retains its red color when canned. Said to be hardy.

Ruben: A chance seedling, found in a thick wood in August, 1904, in Sebastian County, Ark. "Fruit of large size and excellent quality; clingstone; ripens in August. Desirable for canning and shipping. Very hardy." Arkansas Nursery Company, Fayetteville, Ark.

Sabichi Winter: Armstrong Nurseries, Ontario, Cal. "Medium size; very late; flesh white, juicy, sweet and mellow, of excellent flavor, clings slightly to the pit, ripens as late as December."

Sage: German Nurseries, Beatrice, Neb. A chance seedling originating in Beatrice, Neb. Fruit the size of Elberta, dark yellow with deep crimson blush, very attractive; flesh yellow, very firm, juicy and of excellent quality; freestone. Tree vigorous, healthy, very hardy, productive. September and early October.

Sunshine: Foster Nurseries, Denton, Texas. "Large, yellow with red blush, firm, juicy and fine flavor. September 16. Introduced by us."

Sutter Creek (S. P. I. No. 36125): A peach of large size and good quality; ripens a little later than Elberta which it resembles. Original tree on grounds of F. E. Downs, Sutter Creek, Hamador County, California.

Vainqueur (S. P. I. No. 33219): From Granada, Spain. Fruit medium to large, yellowish tinged with pink; flesh greenish-white or pink, quality fair; season very early.

Winner: Chase Brothers Company, Rochester, N. Y. "Ripens about a week earier than Elberta; otherwise the same or a trifle better quality."

Wooster: Champion Nurseries, Perry, Ohio. Originated on the fruit farm of Mr. Wooster about 20 miles from Pittsburgh. Fruit large, yellow with red cheek; high quality; freestone, last of September in northern Ohio.

Zickler: "Originated on the E. H. Zickler place, near Buena, Washington. Colors earlier than the Elberta, has less fuzz in its skin, the fuzz being more like sandpaper, stands up well; fine flavor." The Packer; Oct. 7, 1922.

PEACHMOND

Peachmond: Said to be a hybrid between the peach and almond and was produced by Dr. Juan Balme, plant breeder of the Mexican Horticultural Department, Mexico City. This is a result of pollinating a peach blossom with pollen of the edible almond. The flesh of this new fruit is sweet and juicy and the kernel is of the size, consistency and taste of the edible almond. Farm and Ranch, November 25, 1922.

NECTARINES

Darwin: The F. E. Conine Nursery Co., Stratford, Conn. "An orange nectarine, handsome and delicious."

Davis: American Nurseryman, October, 1922. Original tree a seedling in the yard of a Mr. Davis, Austin, Texas. Six-year old tree has borne four crops. Ripens late in June.

Dryden: The F. C. Conine Nursery Co., Stratford, Conn. "Large, fine flavored, deep red."

Large Red (Tribble): Tribble Nurseries, Lodi, Cal. "A seedling originating on our Elk Grove place. Very large; skin deep marble red; very firm; productive and superb quality."

Milton: The F. C. Conine Nursery Co., Stratford, Conn. "Very large, deep red, finely flavored."

New Boy (S. P. I. No. 43144): From Auckland, New Zealand. Fruit said to be of very fine quality and ripens August 10 at Sacramento, Cal.

Quetta: Tribble Nurseries, Lodi, Cal. "Recently introduced from Quetta, British India. Very large, beautiful color, rare rich flavor; heavy bearer. August."

Sharpe's: Tribble Nurseries, Lodi, Cal. "A wonderful new nectarine from Vacaville. Has all the good qualities for canning, drying and shipping."

PLUMS

Bolshevick: Melba Nursery, Melba, Iowa. Not described.

Chinese Red: Tribble Nurseries, Lodi, Cal. "New importation; better than Burbank for all purposes, but not quite as large. Late June."

Delicious: Originator, John Stevens, Webster City, Iowa. About the size of a walnut. Freestone. American Nurseryman, October, 1922.

Early Funk: Foster Nurseries, Denton, Texas. Fruit medium size, light red, very attractive; flesh yellow streaked with red, good quality, very early, May 1 to 10 in Texas.

Extra Early Cherry: Originated in the nursery of the California Nursery Company, Niles, Cal., catalog 1920. "Of the Myrobolan type; about one inch in diameter; bright red with yellow flesh; flavor brisk and agreeable; has ripened here May 26 and will be even earlier in most sections of California. A sure and heavy bearer with us." California Nursery Company.

Extra Early Satsuma: Leonard Coates Nursery Company, Morganhill, Cal. Not described.

Golden Rod (Minn. No. 120): "A seedling of Shiro x Howard Yellow originated by the Minnesota Experiment Station. Tree is tall, vigorous, upright in form, hardy, productive; fruit medium to large in size, round, clear yellow; flesh firm, moderately juicy, moderately sweet; fair to good in quality, stone medium in size, cling; season last of August. Very promising as a market plum."

Hennepin (Minn. No. 132): "A seedling of Satsuma x Americana originated by the Minnesota Experiment Station. Tree is vigorous, medium in size, hardy, produces a round head; fruits medium to large in size, deep dark red; flesh dark red, firm, juicy, sweet, sprightly; quality very good; stone medium size, semi-cling; ripens mid-season. A valuable variety for home and market use. Especially recommended for preserving."

Herald (Prune): Fruit oblong, bright red, with blue bloom; dots white, very numerous; flesh sweet, yellow, juicy, melting but clings tenaciously to pit. Fruit hangs on the tree a long time after maturity and dries easily either on or off the trees. Not very promising as a dried prune. Original tree owned by W. F. Marshall, Raleigh, N. C. Information supplied by Prof. L. R. Detjen, Newark, Del.

La Crescent (Minn. No. 109): "A seedling of Shiro x Howard Yellow, originated by the Minnesota Experiment Station. Tree extremely vigorous, very large, upright, oval head; medium to heavily productive; fruit medium in size, slightly oval, clear yellow, sometimes with delicate blush; very tender, fine-grained flesh, juicy, sweet; of highest quality; stone medium in size, semi-free; season very early. A very promising variety for home use because of its high dessert and cooking qualities, probably not firm enough for a good shipping variety."

Leighton (Improved Italian): Not described. Said to be superior to the ordinary Italian.

Maloney (Prune): Maloney Bros. & Wells Company, Dansville, N. Y. "Fruit large, color dark blue; flesh yellow and delicious; freestone; heavy annual bearer. Season September 15 until freezing weather, quality of Fellenburg and size of York State prune."

Manitou (Minn. No. 7): "A seedling of Siberian Almond (Amygdalus Nana) x Bokhara Peach. This variety is a vigorous shrub-like tree of medium size and very hardy. It is especially attractive because of the great mass of pinkish-white flowers put out in the early spring. The foliage remains healthy throughout the season. The flowers are sterile and plant unfruitful."

May's Victory: May Seed & Nursery Company, Shenandoah, Iowa. "It combines hardiness, immense size, delicious quality, long keeping, beautiful color, small pit and early bearing. Hardy anywhere in the northwest."

Newport (Minn. No. 116): "A seedling of Omaha x Prunus Pissardi originated by the Minnesota Experiment Station. A plum tree of striking appearance; moderately vigorous, upright growing, hardy, foliage of a deep reddish-purple color, retaining its color throughout the season; fruit is small to medium in size, of very poor quality and of little value. The tree is valuable for its striking foliage color."

Sacramento: Leonard Coates Nursery Company, Morganhill, Cal. Not described.

Santa Barbara (Prune): Leonard Coates Nursery Company, Morganhill, Cal. Not described.

Sharkey: Leonard Coates Nursery Company, Morganhill, Cal. Not described.

Soviet: Melba Nursery, Melba, Iowa. Not described.

St. Anthony (Minn. No. 134): "Parentage lost but a sand cherry hybrid of a breeding similar to the Zumbra. Tree is vigorous, productive, hardy, small size, slightly larger than Zumbra; fruit small to medium, round, dark, purplish black; flesh moderately firm, juicy; of good quality when fully ripe, excellent for preserving; season late August."

Tulsa: Minnesota Horticulturist, October, 1922. Not described.

Waconia (Minn. No. 10): "A seedling of Burbank x Wolf originated by the Minnesota Experiment Station. Tree is large, vigorous, spreading grower, productive, hardy; fruit is medium to large in size, roundish-conic, red; flesh firm, moderately juicy; quality good; mid-season; stone medium in size, cling; a promising commercial variety."

Yellow Russian: Tribble Nurseries, Lodi, Cal. "New; peculiar flavor; bright yellow; good size; sweet and good. Introduced from Russia."

CHERRIES

Bassford: Tribble Nurseries, Lodi, Cal. "Claimed to have been originated by H. A. Bassford of Vacaville, and to be a Lambert seedling. The fruit is very large, many of them packing 8 row. Very similar, if not identical with the Bing."

Chinese Cherry: Leonard Coates Nursery Company, Morganhill, Cal. Not described.

Early Chinese: Tribble Nurseries, Lodi, Cal. "The earliest of all cherries; pink color; fairly firm, very productive; not subject to gum disease; very hardy. Ripens first of April."

Moulton Sweet: Noble Nursery, Noble, Okla. "Either a new variety or an unidentified European variety growing at Moulton Fruit Farm, west of Oklahoma City. Fruit large, meaty, light red; mid-season, high quality."

Royal Queen: Tribble Nurseries, Lodi, Cal. "One of the finest Bing types we have seen. Will pack nine, eight or seven row. Ripens with Bing."

Talley's Favorite: Hardy-Field Nursery & Seed Company, Kansas City, Mo. "Original trees received from Ireland (?) by a Mr. Talley of Winchester, Tenn. Resembles Montmorency, but a little larger and not so sour. Productive."

APRICOTS

Beni Kaga (S. P. I. No. 54709): From Okitsu, Shiznokaken, Japan. An early flowering variety, blossoms white, medium size; fruits medium size.

Beni Sashi (S. P. I. No. 54710): From Okitsu, Shiznokaken, Japan. Blossoms small, white, open early; fruit small, red.

Bungo (S. P. I. No. 54711): From Okitsu, Shiznokaken, Japan. A late flowering variety with large light red blossoms. Fruits large.

Colorado: Stark Bros. Nurseries, Louisiana, Mo. From the Grand Valley, Colorado. Fruit said to be very large, tree very productive, and said to freeze back less than other varieties there.

Crab: Pawnee Rock Nurseries, Pawnee Rock, Kans. Not described.

Dallas: Enterprise Nurseries, East Prospect, York County, Pennsylvania. Not described.

Darby Early Royal: Van Dusen Nurseries, Geneva, N. Y. Probably a seedling of Montgamet. Hardy; regular-bearer.

Every-Year: Kirkman Nurseries, Fresno, Cal. Identical with the Royal in size, color, flavor and texture. June 1st to 10th.

Haua Kami (S. P. I. No. 54712): From Okitsu, Shiznokaken, Japan. Blossoms small, light red; fruit medium size, light brown; mid-season.

Inkyo (S. P. I. No. 54713): From Okitsu, Shiznokaken, Japan. Blossoms medium size, white, open early; fruits large.

Joshu (S. P. I. No. 54714): From Okitsu, Shiznokaken, Japan. Blossoms light red, small, double; fruits large, mid-season.

Ka Mume (S. P. I. No. 54716): Blossoms small, white; fruits very small, mid-season.

Kichirobei (S. P. I. No. 54715): Blossoms white, medium size; fruits large; mid-season.

Koshu (S. P. I. No. 54717): Blossoms small, white, rather late; fruits very small.

Losse: Kirkman Nurseries, Fresno, Cal. Originated in the Santa Clara Valley. Not described.

Masui (S. P. I. No. 54718): From Okitsu, Shiznokaken, Japan. A late blooming variety with small white blooms; fruits large.

Rinshu (S. P. I. No. 54719): From Okitsu, Shiznokaken, Japan. Blossoms medium size, light red, double; fruits large.

Shidare (S. P. I. No. 54721): From Okitsu, Shiznokaken, Japan. Blossoms white, small, branches drooping, fruit small, mid-season.

Shira Kaga (S. P. I. No. 54722): From Okitsu, Shiznokaken, Japan. Blossoms medium size, white, late blooming, fruits, large.

Stella: Stark Bros. Nurseries, Louisiana, Mo. Originated in Nebraska by the late Theo. Williams. "Unsurpassed for productiveness, size,

color and quality. Strong grower, large beautiful foliage, entirely hardy in Nebraska where very few apricots will stand."

Tama Mume (S. P. I. No. 54723): From Okitsu, Shiznokaken, Japan. Blossoms medium size, white, fruits rather large, clear green, mid-season.

Yoro (S. P. I. No. 54725): From Okitsu, Shizokaken, Japan. Blossoms small, light red, fruit medium size.

RASPBERRIES

Cayuga: Seedling of June x Cuthbert, originated by the Agricultural Experiment Station, Geneva, N. Y. Plants very vigorous and very productive; berry large, roundish-conic; drupes medium, strongly coherent, medium red, slightly glossy, juicy, firm but tender, sprightly, aromatic, very good. Berry resembles Cuthbert in appearance and is nearly equal to Cuthbert in flavor.

Fewthorn: Hybrid between Minnetonka Ironclad and a wild red raspberry from the Black Hills, originated by N. E. Hansen, Brookings, S. D. Berry about ¾ inch in diameter, dark red, firm, good keeper. Canes almost thornless except for a few weak bristles near the ground.

Gold Dollar (of Townsend): Introduced by E. F. Townsend & Son, Salisbury, Md. Large, productive, sweet, juicy, rich golden yellow.

Greek: Minnesota Horticulturist, April, 1920. "Black."

Moonbeam: Originated by N. E. Hansen, Brookings, S. D. Hybrid between the wild red raspberry of Cavalier, N. D., with a hybrid between the Black Hills red raspberry and Shaffer. Berry large, firm, late. Plant has few thorns and is dwarf in habit of growth.

Owasco: Seedling of June x Cuthbert, originated by the Agricultural Experiment Station, Geneva, N. Y. This variety is not as strong a grower as Cayuga and Seneca. Berry very large, long conic, medium to dark red, juicy, firm, tender with Cuthbert flavor.

Panhandle: Clarendon Nursery Company, Clarendon, Texas. "Originated by A. L. Bruce in our trial grounds here."

Seneca: Seedling of June x Cuthbert, originated by the Agricultural Experiment Station, Geneva, N. Y. This new variety is very similar to Cayuga except the drupes average slightly larger, berry slightly more conic and flavor slightly more sprightly and the season is a few days later.

Smooth Cane: Hybrid between wild red raspberry of the Black Hills and Minnetonka Ironclad, originated by N. E. Hanson, Brookings, S. D. Berry ¾ inch in diameter, quite firm; plant strong and stocky; cane thornless.

Spineless: A hybrid of the wild red raspberry from Cavalier, N. D. x Loudon. Originated by N. E. Hansen, Brookings, S. D. Berry about three-fourths inch in diameter of extra good flavor. Canes thornless.

Starlight: Originated with N. E. Hansen, Brookings, S. D. Hybrid between the wild raspberry from Cavalier, N. D., with Minnetonka Ironclad. Canes have few thorns. Fruit somewhat larger than Ohta and equally bright in color.

Todd Perfection: King Bros. Nurseries, Dansville, N. Y. Said to be an extra early red variety of great merit, coming from the Hudson River fruit section. Said to be a good early shipper. Canes very vigorous.

Twilight: Originated by N. E. Hansen, Brookings, S. D. Berry larger than King in S. D., clear light red, quality good. Canes strong and stocky with few thorns.

Watson's Prolific: T. S. Hubbard Company, Fredonia, N. Y. "New blackcap raspberry of large size; exceedingly productive, high quality; plant strong and vigorous grower."

BLACKBERRIES

Albro: L. J. Farmer, Pulaski, N. Y. Originated by Mr. Albro of Cortland County, New York, and introduced by J. L. Farmer. Berry very large, larger than Snyder and same shape; flavor excellent; plant very hardy.

Bruce: Clarendon Nursery Company, Clarendon, Texas. Not described.

Bushel: Shady Lawn Nurseries, Hammonton, N. Y. Hardy. Productive. In growth like the Black diamond. Berry large, fine flavor.

Texas Evergreen (Texas Everbearing): J. T. Lovett, Little Silver, N. J. Said to have been brought from South Africa by a Mr. Texas. "Described as having canes of upright habit, similar to the old Lawton or the Eldorado and to be everbearing in habit; berries jet black, sweet, juicy, without core and as large as English walnuts."

BLUEBERRIES

Adams: Introduced by Joseph J. White, Inc., New Lisbon, N. J. Earliest of the Whitesbog Blueberries. Do not often exceed an inch in diameter. Uniform in size, of excellent flavor, very productive, medium blue, tendency to pear-shape.

Cabot (Coville hybrid 834-A): Introduced by Joseph J. White, Inc., New Lisbon, N. J. Early, very large and of attractive appearance. Flavor a delightful combination of sweetness and subacidity.

Dunfee: Introduced by Joseph J. White, Inc., New Lisbon, N. J. Productive. Berries large, dark.

Grover: Introduced by Joseph J. White, Inc., New Lisbon, N. J. Among the largest of the Whitesbog group. Almost as late as Rubel. Bushes strong and vigorous.

Katharine (Coville hybrid 830C): Introduced by Joseph J. White, Inc., New Lisbon, N. J. Same parentage as Pioneer. Berries a week to ten days later than Pioneer; they average larger and are exceedingly beautiful.

Pioneer (Coville hybrid 620-A): Introduced by Joseph J. White, Inc., New Lisbon, N. J. The first seedling from the government trial grounds selected for propagation. Productive. Berries large, light blue, sometimes slightly streaked, of good flavor.

Ralph: Introduced by Joseph J. White, Inc., New Lisbon, N. J. But few berries surpass half inch in diameter, uniform in size, early, of good flavor; beautiful light blue.

CURRANTS

Siberian Black: Collected by N. E. Hansen, Brookings, S. D., in the Tomsk Province of Siberia. Fruit of good size and plant perfectly hardy.

Thoburn: Noble Nursery, Noble, Okla. "Collected from Western Oklahoma and Colorado by former Secretary of Agriculture, J. B. Thoburn. The bushes resemble those of the wild black currant . . . are just as hardy here and much more prolific. Instead of black they bear dull red, bright yellow, yellow with red stripe, and greenish amber colored fruits of good quality, highly prized for pies, jellies and preserves."

GOOSEBERRY

Poorman's Delight: J. T. Lovett, Little Silver, N. J. Berries large, bright red. Plants of strong, upright habit, with attractive glossy leaves.

STRAWBERRIES

Bayside: S. C. Atherton, Greenwood, Delaware. Originated at Bridgeville, Del. Berry nearly as large as Gandy, very smooth and round; flesh firm, dark red; mid-season.

Beacon (Per.): Seedling of President x Marshall, originated by the Agricultural Expermient Station, Geneva, N. Y. Plants vigorous and productive; fruit ripens early, is large, blunt wedge to blunt conic, medium to dark red, glossy; flesh red to center, juicy, firm, subacid, good, holds up size well. In five out of six years it has ranked among the best grown at Geneva.

Big Late (of Townsend) (Imper.): E. W. Townsend & Son, Salisbury, Md. Plants tall and robust; fruit large, bright red, shiny, of highest aromatic flavor, firm; medium late.

Bliss (Per.): Seedling of Chesapeake x Atkins Continuity, originated by the Agricultural Experiment Station, Geneva, N. Y. Plants vigorous and productive; fruit medium to large, blunt-conic to blunt wedge, medium red, very glossy; fresh medium, firm, very juicy, mild, sweet or pleasantly sprightly, highly flavored, good to very good; ripens in late mid-season. Bliss has ranked among the best for five years at Geneva.

Bouquet (Per.): Seedling of Chesapeage x Pan-American. Originated by the Agricultural Experiment Station, Geneva, N. Y. Plants vigorous and productive; fruit medium to large, blunt-conic to blunt wedge, medium to light red, glossy; flesh well colored to center, juicy, very firm, subacid, good; fruit ripens in early mid-season.

Champion (of Whitten) (Per.): C. E. Whitten & Son, Bridgeman, Mich. "Champion is a heavy, prolific bearer, yielding generous crops from early June until after killing frosts occur in late autumn. It was first introduced by Mr. E. L. Lubke of this state (Michigan)." Said to be larger and more productive than Progressive and equally good in flavor and quality.

Chaska: Not described. Minnesota Horticulturist, August, 1922, page 236.

Cooper (of Emlong): Stevensville Nurseries, Stevensville, Mich. A chance seedling discovered by B. A. Cooper, Cassopolis, Mich. Fruit said to be very large and beautiful, sweet and lucious. Plants said to be very productive. Introduced by the Stevensville Nurseries in 1921.

Early Charley: Central Nurseries, St. Catherine, Ontario. "The earliest strawberry grown."

Everbearing Surprise: Bruns Seed Company, Washington, Iowa. Said to be a special strain of Progressive.

Glen Saint Mary (Per.): Originated by W. M. Ventling, Glen Saint Mary, Florida. Klondyke x Nick Ohmer. Introduced by the Glen Saint Mary Nurseries Company. Very uniform in shape and size, broadly conical, deep rich red; flesh firm, deeply colored throughout, flavor and quality good; mid-season.

Gold Coin: Chance seedling, discovered by A. B. Katkamier, Macedon, N. Y. "Everbearing." American Nurseryman, October, 1922.

Harlan: Joseph Bancroft & Son, Cedar Falls, Iowa. Not described.

Kellogg's Delicious (S.): R. M. Kellogg Company, Three Rivers, Mich. Introduced in 1922 by the R. M. Kellogg Company. Plant vigorous and healthy, enormously productive; berry large, short-conic, dark red; flesh dark red throughout. Quality delicious; berries produced in large clusters on strong sturdy fruit stems; mid-season.

Kellogg's Marvel (S.): R. M. Kellogg Company, Three Rivers, Mich. Supposed to be a cross between Dunlap and Warfield. Plant vigorous; berry longer and firmer than Dunlap or Warfield; flesh deep red throughout, quality excellent; season late.

Parker (Imper.): The Cassell Nursery, Mantua, Ohio. "Fruit extra large to the last picking, ripens early to mid-season; color a bright crimson. Will produce more quarts than Warfield and average twice the size of Dunlap. Plant is a vigorous, thrifty grower."

Philadelphia Beauty: The Moore Seed Company, Philadelphia, Pa. "This

is the largest strawberry in existence. Plant is strong and healthy; berry conic and regular in shape; quality unsurpassed and the size unequaled, some attaining the enormous size of 3 inches in diameter. Color bright red, is firm, a good keeper and will ship well, has perfect blossoms and holds its size through the season and remains in bearing a full month."

Rockhill: R. M. Kellogg Company, Three Rivers, Mich. No complete description given. Berry said to be bright red with a flavor superior to any other strawberry, earlier than Premier, and very productive. This is the Everbearing variety for which the R. M. Kellogg Company is reported to have paid $50,000.00. Originated as a cross of Progressive x Early Jersey Giant by Harlow Rockhill, Conrad, Iowa.

Skeena Wonder: British Columbia Department of Agriculture, Circular No. 58, January, 1922. A seedling originating with Mechaud Brothers, Terrace District, B. C. Supposed to be a seedling of Magoon x Premier. Has the foliage of Magoon and the size, color and smoothness of Premier.

The Allegan Gentlemen (Per.): The Allegan Nursery, Allegan, Mich. Originated with the Allegan Nursery. "The berries resemble Chesapeake, perhaps not quite so dark in color, but a much heavier yielder. They are large and symmetrical and of a decidedly new and pleasant flavor. Its foliage resembles that of Sample yet it is of a little more robust and stalkier habit. Medium to very late in season."

Van Sant: British Columbia Department of Agriculture, Circular No. 58, January, 1922. "A good shipper and of good quality."

Waits Perfection: A. B. Katkamier, Macedon, N. Y. "It is of the Superb type but a firmer and more productive variety." Everbearing.

GRAPES

Brocton: Seedling of Brighton x (Winchell x Diamond), originated by the Agricultural Experiment Station, Geneva, N. Y. Clusters long and shouldered; berry medium to above in size, oval, yellowish green; flesh tender, sweet, aromatic, vinous, very good; ripens with or before Niagara.

Champagne: Shady Lawn Nurseries, Hammonton, N. J. "Berries very large; color a coppery red. An immense producer, very strong grower, 15 to 20 feet or more a season being common. Has never been known to winter kill."

Desmond: Swan River Nursery, Patchogue, N. Y. A white variety, not described.

Dunkirk: Seedling of Brighton x Jefferson, originated by the Agricultural Experiment Station, Geneva, N. Y. Cluster medium size, compact; berry medium size, roundish oval, red, juicy, tender, slightly meaty, good to very good.

Fresno Beauty: Kirkman Nurseries, Inc., Fresno, Cal. This is the old variety, Gros Guillaume, renamed.

Ideal (of Hulbert): J. T. Lovett, Little Silver, N. J. Originated with James Hulbert of Ohio. "Vine vigorous, hardy, prolific; clusters compact, seldom shouldered, of good size. Berries medium size, jet black with a heavy blue bloom, and with a thin, tough skin, Texture tender, melting, vinous, flavor brisk, sprightly and of almost honey sweetness; season quite early."

Kandihar: Tribble Nurseries, Lodi, Cal. "A Persian variety of immense size; beautiful creamy amber color; firm flesh and a splendid variety."

Knight: Fruitland Nurseries, Augusta, Ga. Originated at Savannah, Ga.

Bunch compact, berry medium, blue-black; very prolific; vigorous grower. Commences to ripen last of July and fruit matures through a long period.

Malpay (Synonym of Red Malga): Tribble Nurseries, Lodi, Cal.

Molinera Gordo (Synonym of Castiza): Tribble Nurseries, Lodi, Cal.

Pontiac: Seedling of Herbert x Worden, originated by the Agricultural Experiment Station, Geneva, N. Y. Cluster above medium size; berry medium to large, roundish oval, black with blue bloom; flesh slightly tough, very sweet, good. Pontiac is self-sterile, but will be distributed for the home garden on account of its good quality.

Sheridan: Seedling of Herbert x Worden, originated by the Agricultural Experiment Station, Geneva, N. Y. Cluster large, compact; berry medium to large, black; skin thick and tough; pulp medium tough, sweet, slightly foxy, good to very good; good keeper, ripens about one week later than Pontiac and Concord; blossoms self-fertile.

Urbana: Seedling of Ross x Mills, originated by the Agricultural Experiment Station, Geneva, N. Y. Cluster large, compact; berry small to large, oval, dark red; flesh crisp, meaty, sweet, vinous, very good; season late; recommended for localities with a long season.

Virginia Dare: Fitzgerald's Nursery, Stevensville, Texas. Said to be a most vigorous grower. Grapes large, dark red, juice red. "This grape is related to the Mustang grape but all the hot burny taste has been bred out of it and we have left one of the most delicious of all grapes." Vines very productive, especially valuable for arbor planting.

PERSIMMONS

Delicious: Fancher Creek Nurseries, Fresno, Cal. "Fruit large, juicy, sweet."

Leona: The Austin Nursery, Austin, Texas. "Origin Texas; very fine; seedless. Ripens September and October."

Pang Shang: Tribble Nurseries, Lodi, Cal. "Very rare; fruit flat; red color; fine quality; large; heavy bearer."

Tald jat soa: Tribble Nurseries, Lodi, Cal. "Immensely large, flat, orange red, good quality; found growing in great orchards in Pautingfau valleys, China."

Ta shi tse: Tribble Nurseries, Lodi, Cal. "Large, flat, averaging about 4½ inches in diameter. Red color and very highly prized by the Chinese."

Tribble's Seedling: Tribble Nurseries, Lodi, Cal. Seedling of Tanenashi. Fruit large, tomato shaped, free from astringency when hard and can be peeled and eaten like an apple. Early.

ORANGES

Algerian Satsuma: R. M. Teague Citrus Nurseries, San Dimas, Cal. Not described.

Avon Everbear: Everbear Nurseries Company, Inc., Lakeland, Fla. Fruit of Valencia type, large, high color, very juicy, full flavored, little rag, few seeds, original tree said to have been in almost continuous bud, blossom and fruit bearing for eight years before knowledge of it became general.

Capuchin (S. P. I. 54651): Brought from Chile by Mr. Wilson Popenoe. Fruit small 1½ to 2 inches in diameter, round, deep orange color and thin skin; flesh juicy, flavor much like Washington Navel and of about the same season. Trees dwarf in size, very productive.

Elopine: Florida Grower, May 20, 1922. Originated at Bartow, Fla. "The fruit of the parent tree averages 176 or less to the box and is perfectly round. Rind medium in thickness and texture. Said to be much deeper in color than the usual Florida orange. Mid-season, flavor said to be splendid."

Long's Everbearing: Florida Grower, May 20, 1922. Originated at Lake Helen about 1892. "A true everbearing orange."

Moonshine: Florida Grower, May 20, 1922. Originated at Parrish, Fla. "A late orange, to be marketed from May to July and is said to have a splendid flavor with very few seeds to none at all."

Thanksgiving: Florida Grower, May 20, 1922. Originated at Mt. Dora, Fla., from the seed of the "Clementine," a member of the tangerine family which the Federal Government imported from Algiers in Africa. "The fruit averages a little smaller than a tangerine and the rind is not quite so deep a red, but is very thin. The tree is said to be a little hardier as regards cold and drought than the round orange, to be prolific and the fruit to be delicious. It is ripe and perfectly colored by November 1st and will hang on, it is claimed, until February."

Ward's Early: Florida Grower, May 20, 1922. Originated at Orlando, Fla. "An early orange reported to be superior to the Parson Brown in appearance, early coloring and flavor."

LIME

Russell River (S. P. I. No. 55447): From Brisbane, Queensland; native to the Bellenden-Ker region of North Queensland. Tree resembles the orange, having the same dark green foliage; flowers very small, white, odorless; fruits oval or oblong, about 2½ inches long, ribbed; pulp with sharp but agreeable flavor.

AVOCADOES

Benik (No. 21) S. P. I. 44626: Parent tree was growing in Antigua, Guatemala, but is probably dead now. Fruit very large weighing 20 ounces, broad pyriform to obovoid; skin rather thin, fairly pliable but coarsely granular in texture, purplish maroon color; flesh rich creamy yellow, firm, rich, excellent; seed medium, tight in cavity. Season February to May.

Billingsley: Parent tree owned by Ray Billingsley, Villa Park, Orange County, Cal. Fruit pear shape or oval, light yellowish green, weighs from ten to sixteen ounces; flesh clear bright yellow, only a trace of fiber, quality excellent with a good rich and agreeably distinctive flavor. California Cultivator, June 10, 1922, page 628.

Chabil (No. 36): S. P. I. No. 45564: Parent tree owned by Ignacio Hernandez, San Lorenzo del Cubo, Guatemala. Fruit nearly round, below medium size, weighs 9 ounces; skin thick, very coarsely granular, hard and woody, nearly smooth, deep full purple with few large yellowish dots; flesh cream yellow with few fibers, rich and nutty, good; seed medium size, tight in cavity. Season November to March.

Chisoy (No. 11) S. P. I. 43935: Parent tree owned by Senor Don Eusebio de la Cruz, San Cristobal, Guatemala. Fruit large, weighing 20 to 24 ounces, spherical to oblate; skin rather thick, rough, yellowish green; flesh deep yellow, firm and rather dry without discoloration, richest possible flavor; seed small to nearly large, tight in cavity. Season February to April.

Clower: Tree owned by Mr. Shedden, Monrovia, Cal. "It has fruited for several years and produces fruit of good quality and mild agreeable flavor." California Cultivator, June 10, 1922, page 628.

Coban (No. 8) S. P. I. 43932: Parent tree owned by Filadelfo Pineda Coban, Guatemala. Fruit medium size, pear shaped, weighing 15 ounces; surface slightly rough, deep green; skin moderately thick, hard, woody, flesh very deep yellow, quite free from discoloration, smooth and oily, unusually rich flavor; seed small, tight in cavity. Season February and March.

Del Rosa: Bishop's Alta Vista Nursery, Highland, Cal. Fruit about size and shape of Taft, excepting that it is dark purple when ripe. Season January to September. Tree very productive.

Dickey: Fruit medium to large, weighs from 12 to 16 ounces, pear shaped, red turning to reddish purple; flesh yellow, free from fiber, quality and flavor very best; pit very small. California Cultivator, June 10, 1922, page 628.

Dorothea: Originated from a seed of Miller by A. W. Miller, Hollywood, Cal. Supposed to be crossed with a Mexican avocado. Fruit medium to large weighing 8 to 12 ounces; skin leathery, light green with many yellow dots; flesh clear, attractive yellow, no fiber, excellent flavor. Season December to January. California Cultivator, June 10, 1922, page 628.

Dutton: Fruit pyriform, very large, weighing 14 ounces; skin dark maroon with many warts of a lighter color; flesh cream colored or light green, smooth with trace of fiber, very rich. Season early spring. California Cultivator, June 10, 1922, page 628.

Fernandez: Introduced from Santa Marta, Columbia, by Wilson Popenoe. West Indiana race, not described. Florida Grower, July 1, 1922.

Ishim (No. 34) S. P. I. No. 45562: Parent tree owned by Ignacio Hernandez, San Lorenzo del Cubo, Guatemala. Fruit obovate to pyriform, below medium size, weighs 10 to 12 ounces; skin very thin, soft, tender, almost smooth, sometimes pitted, dark maroon purple with many light maroon dots; flesh fine grained, buttery, creamy yellow, sometimes with fiber discolorations, moderately rich and nutty, good; seed large, tight in cavity. Season October to December.

Ishkal (No. 7) S. P. I. 43602: Parent tree in Callejon Manchen No. 4, Guatemala. Fruit small, spherical to obovoid, weighs 6 to 8 ounces; surface rough, deep purple, few large yellowish dots; skin moderately thick, coarsely granular and woody; flesh deep yellow, very rich and pleasant, quality excellent, free from fiber discoloration; seed large, tight in seed cavity. Season January to June.

Kanan (No. 35) S. P. I. No. 45563: Parent tree owned by Ignacio Gonzales, San del Lorenzo Cubo, Guatemala. Fruit nearly spherical, medium to very large, weighs 16 to 20 ounces; skin moderately thick, coarsely granular, woody, brittle, pebbled, bright green with few large yellowish dots; flesh cream color, free from fiber or discoloration, rich and pleasant, very good; seed rather small, tight in cavity. Season December and later. Resembles Trapp as grown in Florida.

Kanola (No. 6) S. P. I. 43560: Parent tree owned by Victor Garcia near Antigua, Guatemala. Fruit small, weighing 6 to 10 ounces, round, attractive glossy purple; flesh yellow, free from fiber, rich oily flavor, excellent quality; seed small, oblate, tight in seed cavity. Tree exceedingly productive. Season very early, October.

Kashlan (No. 10) S. P. I. 43934: Parent tree owned by Diego Muus, San Cristobal, Guatemala. Fruit broadly oval, slightly oblique, large, weighing 20 to 22 ounces; skin thick, smooth, hard, brittle, green; flesh deep yellow, smooth, free from fiber, very rich and pleasant; seed unusually small, fits tightly in cavity. Season early.

Kayab (No. 25) S. P. I. No. 44681: Tree owned by Francisco Muus, San Cristobal, Guatemala. Fruit medium to very large, round, weighs 14 to 20 ounces; skin moderately thick, hard and woody, rough, deep green to yellowish green, many small russet or yellowish dots; flesh cream yellow, firm, dry, without fiber or discoloration, very rich, excellent; seed medium size, tight in cavity. Season February to May. Resembles Trapp as grown in Florida.

Kekchi (No. 22) S. P. I. No. 44679: Parent tree owned by Santiago Mendoza, Purula, Guatemala. Fruit small, pear-shaped or obovoid, weighs about 6 ounces; skin thick, woody, somewhat rough, maroon; flesh rich creamy yellow, somewhat fibrous, buttery, very rich and agreeable, very good; seed small to medium, tight in cavity. Season early. December and later. Tree very productive.

Lamat (No. 3) S. P. I. No. 43476: Originated by Angel Samayoa, Amatitlan, Guatemala. Fruit oval, above medium to large, weighing 14 to 18 ounces; stem stout, inserted obliquely without depression; apex rounded; surface nearly smooth, deep green, few large yellowish green dots; skin thick, coarsely granular, brittle; flesh cream color, fairly rich flavor, very good, free from fiber or discoloration; seed small, almost spherical, tight in cavity.

Linscott: Fruit round, rough, medium to large, weighs about a pound. A Guatemalan seedling. California Cultivator, November 11, 1922, page 499.

Manik (No. 26) S. P. I. No. 45560: Parent tree is growing in Antigua, Guatemala. Fruit medium size, weighs 8 to 12 ounces, oval to elliptic-pyriform; skin thin, hard and coarsely granular, somewhat rough, bright green with few small yellowish dots; flesh creamy yellow, free from fiber or discoloration, firm and unusually dry, rich and pleasant, very good; seed medium size, tight in cavity. Season February to June. Tree productive.

Mayapan (No. 23) S. P. I. No. 44680: Parent tree owned by Arcadio Saguirre, Purula, Guatemala. Fruit round, weighing nearly a pound, medium size or larger; skin very thick, coarsely granular, woody, decidedly rough, greenish purple to dull purple; flesh rich creamy yellow, no fiber discoloration, firm, meaty, rich and pleasant, excellent; seed medium size, tight in cavity. Season March to July.

Nabal (No. 15) S. P. I. No. 44439: Parent tree accidentally destroyed in June, 1917, it stood in Antigua, Guatemala. Fruit almost spherical, below medium size weighing 10 ounces; skin thick, smooth, bright green; flesh rich yellow, free from fiber or discoloration, firm, smooth texture, rich excellent; seed rather small, tight in cavity. Season February and March or later.

Nimlioh (No. 17) S. P. I. No. 44440: Parent tree owned by Trinidad Hernandez, Antigua, Guatemala. Fruit extremely large, broadly oval, weighing 36 to 45 ounces; skin thick, woody, rather rough, deep green with numerous irregular large yellowish dots; flesh firm, oily, smooth, rich creamy yellow, free from fiber or discoloration, very rich, pleasant, excellent; seed medium size, tight in cavity. Season February and March.

Panchoy (No. 18) S. P. I. No. 44625: Fruit above medium to large, weighing 15 to 18 ounces, broadly obovoid; skin thick, woody, very brittle, yellowish green with many small yellow dots; flesh firm, smooth, rich yellow without fiber or discoloration, very rich and pleasant, excellent; seed medium size, tight in cavity. Season January to April.

Pankay (No. 12) S. P. I. No. 44785: Parent tree owned by Jesusa v. de Camey, Totonicapam, Guatemala. Fruit medium size, pyriform,

weighing 12 ounces; skin moderately thick, woody, brittle, smooth, light green with numerous yellow dots; flesh deep cream color, free from fiber, very rich flavor, excellent; seed rather small, conical, tight in cavity. Season September to January.

Prince: Original tree owned by E. W. Dickey, Hollywood, Cal. Fruit pyriform, very large, weighs 21 ounces; skin dark green with brown spots; flesh with trace of fiber showing dark color, smooth texture, good flavor, good keeping quality. Season October to December. California Cultivator, June 10, 1922, page 628.

Robertson: Armstrong Nurseries, Ontario, Cal. Catalog 1922. "Thin skinned; fruit round, medium size; tree a very fast grower and has proven a good bearer; September and October."

Tamayo (S. P. I. No. 54270): From the Chota Valley of Northern Ecuador in 1921. It is either an unusually large fruited Mexican or a hybrid between the Mexican and West Indian races. Fruit of excellent quality, weight about 18 ounces; flesh rich creamy yellow, smooth, flavor delicious; seed rather small; promising for avocado growers in California and Florida.

Tertoh (No. 30) S. P. I. No. 44856: Parent tree owned by Leandro Castillo, Mixco, Guatemala. Fruit oblong to slender pyriform, extremely large, weighs 28 to 48 ounces; skin moderately thick, coarsely granular and woody, nearly smooth, deep dull purple with russet dots and patches; flesh creamy yellow, free from fiber or discoloration, fine texture, rich and pleasant, excellent; seed very small, tight in cavity. Season February to April.

Tiger: Original tree growing at Highland, Cal. Fruit pear-shaped, large, weighs 12 ounces; skin thick, purple, attractive; flavor of flesh agreeable but not high. Tree upright, productive, season latter part of winter. California Cultivator, June 3, 1922, page 591.

Victory: Originated with Mrs. L. M. Chaffey, Sherman, Cal. Fruit large, round, weighs 18 ounces; skin light green turning to brown as it ripens; flesh yellow shading to light green, flavor and quality good. California Cultivator, June 10, 1922, page 628.

Ward: Originated with Irving N. Ward, Sierra Madre, Cal. Fruit large, weighs 12 to 16 ounces, pyriform; skin dark red or purple, shading to black; flesh creamy yellow to pronounced green, texture smooth, flavor good. California Cultivator, June 10, 1922, page 628.

Wilder (S. P. I. No. 55625): From Honolulu, Hawaii. Fruit nearly round, large, weighs about a pound; color light olive green; flesh yellow shading into light green near the skin, oily, rich and nutty; October to January in Honolulu.

Winter Mexican: Indiana River Nurseries, West Palm Beach, Florida. "Pure Mexican seedling which ripens its crop in January. This will be very valuable for Central Florida as it is the only known Mexican which matures in the winter."

MANGO

Brooks: American Nurseryman, October, 1922. Originated by Hezekiah Brooks, Miami, Florida. Similar to the Mulgoba in appearance and texture but is declared to be superior to that variety in flavor. November to January.

CHERIMOYAS

Booth: Originated by Mr. Booth, Hollywood, Cal. "Fruit large, elongated in shape; skin rough; flesh light yellow, exceedingly delicious and rich in flavor. February to April." Armstrong Nurseries, Ontario, Cal., 1922 catalog.

Mammillaris: Originated at Altadena, Cal. Fruit medium size, weighs up to one pound, conical; cavity shallow, broad, flaring; apex rather pointed; stem short and very stout; surface covered with conical protuberances; color dull green; skin thick and very rough; flesh clear white, soft, fine grained; seeds rather short and blunt, plump, not numerous; flavor very aromatic and rich, strongly resembling the pineapple, quality excellent; season February and March. Tree upright, moderately vigorous, productive. The Pomona Journal of Economic Botany, May, 1912.

Golden Russet: Received from London. England, by Mr. Burgess, Villa Park, Cal. Fruit medium large, weighs up to a pound and a half, usually oblong-conical; cavity deep, rather narrow, rounded; apex rounded, broad; stem short and stout; color light green, usually shaded with golden russet; skin rather thick, tender; flesh white, of good texture; seeds oblong, slightly compressed, not very numerous; flavor resembles pineaple somewhat, quality good; season February to April. Tree upright vigorous, broad-topped, fairly productive. Pomona College Journal of Economic Botany, May, 1912.

FIGS

Black Durro: Tribble Nurseries, Lodi, Cal. "The largest fig known. Dark purple; fine flesh; bears two heavy crops and brings highest price as fresh fruit."

Figue de Chios (S. P. I. No. 8506). From the Island of Chios, Greece. Said to be a very excellent variety, ripening in August in Savannah, Georgia.

Goodale Black: Kirkman Nurseries, Inc., Fresno, Cal. Trees fruiting on the property of the Honora Realty Company, Lemon Cove, Cal. Said to bear larger fruit than California Black Mission, which it resembles.

Placer Smyrna (S. P. I. 2182): Tribble Nurseries, Lodi, Cal. "A seedling from the Maslin orchard and seems to be a close rival for the Calimyrna. Fig very large, flat, skin light brown, pulp light amber, syrupy and very sweet. The finest fresh fig we have ever eaten. Requires Capri figs."

White Seedless: Bishop's Alta Vista Nursery, Highland, Cal. Fruit large, yellowish white with pink pulp, very mild flavor; skin firm; usually seedless.

LOQUATS

Golden Nugget: Bishop's Alta Vista Nursery, Highland, Cal. Fruit said to be very large, some weighing five ounces; flavor mild.

Large Fruited: California Nursery Company, Inc., Niles, Cal. "An improved variety; bears when quite young; fruit shaped like a crab apple; flesh white; seeds small; flavor rich, pleasant and sweet."

Victor: California Nursery Company, Inc., Niles, Cal. Not described.

SAPOTE

Oakley: Theodore Payne, Los Angeles, Cal. "A large, rich flavored variety."

CAROBS

Amele (S. P. I. No. 55727): From Bari, Italy. Not described.

Habathi (S. P. I. No. 55448): The tree is productive but the crop is of poor quality.

Matalafera (S. P. I. No. 54977 : Tree of medium size with smooth straight branches; leaves comparatively large, very dark green; pods deep chestnut bordering on black, large, wide, 8 inches long. Grown extensively near Valencia, Spain.

Roches (S. P. I. No. 54978): Pods very sweet, but tree not as productive as Matalafera.

Sandalawi (S. P. I. No. 55449): This variety is of good quality.

Schehabi (S. P. I. No. 55450): Only medium in quality and productiveness.

ALMOND

Toreams: Originated with T. O. Reams, near Suisun, Cal. Introduced by Fancher Creek Nurseries, Fresno, Cal. "Later bloomer; heavy, regular producer. Nuts above average in size; rich in flavor; kernels much larger than I. X. L.; hulls very freely."

PECANS

Aurora: U. S. Dept. Agr. B. P. I. Bulletin 251. From Mobile County, Ala. Nut large; shell rather thick; partitions rather corky; kernel fairly plump, flavor good to very good.

Banquet: West Texas Pecan Nursery, San Saba, Texas. Texas Prolific x Atwater. Very large; immensely prolific; a week earlier than either parent and retains that bright coloring characteristic of both.

Beene: Originated near Marquez, Robertson County, Texas, on the grounds of Mr. W. E. Beene. Nut large, shell thin, meat full, good cracker. Bulletin No. 73, Texas Department of Agriculture, 1922.

Bend: Texas Department of Agriculture, Bulletin No. 73. Not described.

Boggus: "From Gordon, Texas. Sent in by Claude Boles. One among the superior named sorts. History not given." Bulletin 73, Texas Department of Agriculture, 1922.

Brown: From Throckmorton County, Texas, not described. Bulletin No. 73, Texas Department of Agriculture, 1922.

Church Hill: Texas Department of Agriculture, Bulletin No. 73. Not described.

Deavers: From near Temple, Bell County, Texas. Classed with San Saba. Not described. Bulletin No. 73, Texas Department of Agriculture, 1922.

Dependable: A seedling of Jewett x Success. Originated by C. Forkert, Ocean Spring, Miss. This was originally named Williams. Nut medium large to large, oblong, cylindrical, base rounded, apex blunt; color dull, marked with dark splashes of purplish black; shell rather thin; kernel plump, quality very good. Tree vigorous.

Dercherd: Nut medium size, shell thin, splendid cracker. Originated at Junction, Texas. Bulletin No. 73, Texas Department of Agriculture, 1922.

Fort Clark: Texas Department of Agriculture, Bulletin No. 73. Not described.

Frazier: Texas Department of Agriculture, Bulletin No. 73. Not described.

Gladys: Originated with J. C. Hallford, Llano, Texas. Slightly inferior to Hallford. Bulletin No. 73, Texas Department of Agriculture, 1922.

Govertt: Originated near Seguim, Texas. Said to be in a class with Schley but is larger and more prolific. Considered the best of all Texas varieties. Bulletin 73, Texas Department of Agriculture, 1922.

Hallford: Originated along the Colorado River near Kingsland in Llano County, Texas. Tree owned by Mr. J. C. Hallford, Llano, Texas. Nut medium size, thin shell, splendid cracker, equal to Halbert but larger. Bulletin No. 73, Texas Department of Agriculture, 1922.

Harrell: Texas Department of Agriculture, Bulletin No. 73. Not described.

Keith: Originated near Breckinridge, Stephens County, Texas. Nut small, shell very thin, kernel plump, flavor delicious, especially good for home use. Bulletin No. 73, Texas Department of Agriculture, 1922.

Liberty: Texas Department of Agriculture, Bulletin No. 73. Not described.

Lilly: Texas Department of Agriculture, Bulletin No. 73. Not described.

McCullum: Texas Department of Agriculture No. 73. Not described.

McDaniel Prolific: Texas Department of Agriculture, Bulletin No. 73. Not described.

Marquardt: Originated 20 miles north of Burlington, Iowa. Introduced by J. F. Jones, Lancaster, Pa. "Large as the Indiana varieties, with a thin shell and full kernel of excellent quality."

Matsler: Texas Department of Agriculture, Bulletin No. 73. Not described.

Merge: From North Llano, Texas. Not described. Bulletin 73, Texas Department of Agriculture, 1922.

Meyers (of Texas): Originated twenty miles northwest of Austin, Texas. Introduced by F. T. Ramsey, Austin, Texas. Nut above medium size, very attractive, meat solid, sweet and firm. Bulletin No. 73, Texas Department of Agriculture, 1922.

Millican: Texas Department of Agriculture, Bulletin No. 73. Not described.

Oglesby: Texas Department of Agriculture, Bulletin No. 73. Not described.

Onliwon: Originated in the West Texas Pecan Nursery, San Saba, Texas. Medium early. Meat plump and full; well flavored. Annual fruiter.

Papershell: Not described. Bulletin 73, Texas Department of Agriculture, 1922.

Roth-Dewitt: The tree is on the Roth place, between Cuero and Yoakum, Texas. Not described. American Nut Journal, May, 1920, page 60.

Schweitzer: Nut resembles Delmas in every particular except it is about 10 per cent smaller. Said to be very prolific and regular in bearing. Apparently originated at Hocheim, Texas. Bulletin No. 73, Texas Department of Agriculture, 1922.

Slaughter: Originated with R. C. Slaughter, Stephensville, Texas. Nut medium in size with shell about like Stuart. Bulletin No. 73, Texas Department of Agriculture, 1922.

Squirrel's Delight: Originated in the West Texas Pecan Nursery, San Saba, Texas. Not described.

Sutton: Originated on Indian Creek, Brown County, Texas. Nut small, shell thin, superior to Stuart which it resembles. Bulletin No. 73, Texas Department of Agriculture, 1922.

Uvalda: Texas Department of Agriculture, Bulletin No. 73. Not described.

Waukeenah (Probably same as Waukena): U. S. Department of Agriculture, B. P. I., Bulletin No. 251. From Jefferson County, Florida. Nut small; shell of average thickness; kernels generally shrunken; quality below medium; flavor poor. Tree productive. Season very early.

Weisinger: Texas Department of Agriculture, Bulletin No. 73. Illustrated but not described.

Welty: Nut resembles Dercherd except that shell is thinner. Apparently originated at Gordon, Texas. Bulletin No. 73, Texas Department of Agriculture, 1922.

Willis: Texas Department of Agriculture Bulletin No. 73. Illustrated but not described.

Wisdom: Texas Department of Agriculture, Bulletin No. 73. Not described.

PERSIAN WALNUTS

Bacon: Tribble Nurseries, Lodi, Cal. "A fine walnut originating from seed sent out by Mr. G. P. Rixford as premium with the San Francisco Bulletin. Bears very heavy crops of fine walnuts of the Parisienne type. Said not to sunburn or blight. Blooms fairly late."

French: Leonard Coates Nursery Company, Morganhill, Cal. Not described.

Henneman: Discovered by H. A. Henneman, former president of the Western Nut Growers' Association, on a city lot in Portland, Ore. Propagated by Richard H. Turk, Washougal, Wash. "Excels in quality the time-honored Franquette." American Nut Journal, April, 1922.

Knapp: Tribble Nurseries, Lodi, Cal. "A beautiful, large, smooth walnut of the Mayette type; heavy bearer; does not burn or blight. Well filled, white pellicle and a very worthy walnut. Blooms late."

Leib's Mayette: Tribble Nurseries, Lodi, Cal. "A very large, fine walnut, pretty smooth shell, well filled and blooms late."

Manchuria: Tribble Nurseries, Lodi, Cal. "A variety from the mountains of Manchuria, and should stand more cold than most varieties. Nut large, well filled and blooms late."

Mautner: Leonard Coates Nursery Company, Morganhill, Cal. Not described.

Tribble, or Kerr Mayette: Tribble Nursery, Elk Grove, Cal. Not described.

Westfall: Trbible Nurseries, Lodi, Cal. "From Mr. J. C. Westfall, of Colusa County who has a tree that produced 28 pounds of walnuts four years from planting. Nut very large, beautiful white shell, well filled, white pellicle and a very promising variety. Blooms 1st of April."

Wheeler Franquette: Tribble Nurseries, Lodi, Cal. "An abnormally large type of the Vrooman Franquette with all the good qualities of that variety. Blooms April 15."

Woodland: Tribble Nurseries, Lodi, Cal. "Very similar to the Westfall, except that it is larger and more pointed at the apex. Very heavy bearer."

BLACK WALNUT

Benze: Native of Texas. Introduced by the Texas Nursery Company, Sherman, Texas. Not described. Bulletin 73, Texas Department of Agriculture, 1922.

HICKORY NUT

McGee: Not described. Bulletin 73, Texas Department of Agriculture, 1922.

HYBRID WALNUT

Grundel: "A hybrid walnut of exceptional size produced near Oakdale, Stanislaus County, California." California Cultivator, January 26, 1923, page 4.

REPORT OF THE TREASURER

1921					
Dec.	10	Balance on hand			$ 129.36
1922					
Nov.	10	To Cash	76	Annual memberships at $2.00	$ 152.00
		" "	169	Annual memberships at $5.00	845.00
		" "	3	Life memberships	150.00
		" "	37	Collegiate memberships	37.00
		" "		Society memberships	105.40
		" "		Contributions	312.50
		" "		Reports sold	49.00
		" "		Miscellaneous	7.25
		" "		Interest on bonds	200.00
					$1,987.51
1921					
Dec.	13	By Cash		D. L. Auld Co., medals for judging contest	$ 67.20
	28	" "		F. J. Heer Printing Co., printing letterheads, envelopes, proclamations, folders, etc	119.75
	31	" "		Frances Carlisle, December salary	40.00
1922					
Jan.	7	" "		Celia McDaniels, stenographic service	$ 15.00
	11	" "		R. B. Cruickshank, office expense	75.00
		" "		Celia McDaniels, stenographic expense	5.00
	23	" "		Frederic Cranefield, travel expense	29.09
Feb.	2	" "		Frances Carlisle, January salary	40.00
		" "		F. E. Dillan, stenographic services at annual meeting	147.55
		" "		Dorothea Skinner, stenographic services	25.00
		" "		R. B. Cruickshank, office expense	4.47
		" "		R. B. Powers, printing ribbons	2.20
	4	" "		W. S. Perrine, travel expense	21.22
	13	" "		R. B. Cruickshank, salary account	100.00
Mar.	1	" "		Frances Carlisle, February salary	40.00
		" "		F. J. Heer Printing Co., letterheads	17.00
	2	" "		W. W. Farnsworth, travel expense	28.54
	8	" "		F. J. Heer Printing Co., circulars, envelopes	27.50
	16	" "		F. J. Heer Printing Co., envelopes, folders	77.50
	17	" "		F. J. Heer Printing Co., president's address	45.00
Apr.	2	" "		Frances Carlisle, March salary	40.00
	29	" "		R. B. Cruickshank, office expense	100.00
		" "		Frances Carlisle, April salary	40.00
May	8	" "		F. J. Heer Printing Co., envelopes	50.00
June	5	" "		Frances Carlisle, May salary	40.00
	14	" "		F. J. Heer Printing Co., envelopes	25.00
July	12	" "		Frances Carlisle, June salary	40.00
		" "		Simons Bros. Co., Wilder medals	67.50
	25	" "		R. B. Cruickshank, office expense	65.20
Aug.	11	" "		Frances Carlisle, July salary	40.00
Sept.	2	" "		Frances Carlisle, August salary	40.00
	16	" "		Trafford Tallmadge Co., premium on bond	27.68
	17	" "		F. J. Heer Printing Co., envelopes	50.00
	29	" "		Frances Carlisle, September salary	40.00
Nov.	1	" "		Frances Carlisle, October salary	40.00
	2	" "		Trafford-Tallmadge Co., balance on premium	6.31
	9	" "		W. W. Farnsworth, travel expense	87.07
		" "		F. J. Heer Printing Co., printing	246.00
				Total	$1,971.94
				Cash to balance	15.57
					$1,987.51

REPORT OF THE SECRETARY

During the past year, the American Pomological Society by adoption of the recommendations in the presidential address of Dr. L. H. Bailey at the Toledo convention and through the action of the Executive Committee began to operate on a new, definite, widespreading program for the advancement of pomology. It is necessary at this time to give an accounting of the work done.

The Annual Report has been published and distributed. This, together with the Pomological Annual, comprise a book of over 400 pages and contains much material of value to fruit growers.

One bulletin was issued. This included Dr. Bailey's presidential address last year and was of historical interest. It was mailed not only to members, but to all agricultural colleges and experiment stations and to state horticultural societies. Lack of sufficient funds prevented the publication of other prospective bulletins.

Mimeographed letters were sent out at frequent intervals which contained information relative to the society, reports on the size, condition and prices of the fruit crops, matters of general interest in the fruit industry and suggestions of cultural practices. These letters fell far short of their possibilities, but with a gradually better organization, they can be made of large value to members, alone much above the cost of membership.

Letters were sent out to all agricultural colleges, experiment stations and departments of agriculture asking them to issue at least one publication during the year on the health and food value of fruit. This should be reported and a check made of the material distributed. There is a large field for development of this work through many agencies, a large part of which would be free service. The Society is planning on extending its efforts in this connection during the coming year. A committee will report at this meeting on a fruit slogan. Nothing was attempted this year with reference to the export trade.

Fifteen state, provincial, and local horticultural societies are now affiliated with the American Pomological Society. A large increase in interest has developed, much correspondence has passed between them and us and we have been able to send them considerable information which has been of value to them in the way of organization, program making and current interest. The secretaries of many state and provincial societies have assisted in carrying out the work and development of the American Pomological Society. This meeting and exhibit is an indication of the spirit of cooperation being manifested. In this field, the future lies in a close working arrangement between the parent society and the state, provincial, district and local societies for mutual benefit.

A committee met with a committee from the Federated Fruit and Vegetable Growers, Inc., and in conference agreed that the fields of the two organizations were separate and that they could be of mutual benefit to each other. Their work is purely marketing, chiefly through cooperative associations; ours is largely educational and promotional and our membership is mostly individuals.

The American Pomological Society has always interested itself in the development and testing of new varieties. It maintains committees on new, tropical and on foreign fruits.

At the last meeting three silver Wilder medals, and two bronze Wilder medals and eleven ribbons of merit were awarded. A silver cup was given to the apple judging team from Massachusetts and medals were awarded to the two highest score contestants. A committee is now at work preparing regulations to govern more definitely the various awards of the Society.

Several new books and bulletins touching on fruit growing were reviewed in the circular letters to members.

The code of nomenclature was revised during the year and will be reported on at this meeting. The report of the committee on new fruits

occupies seventy pages in the annual report. The committee on nomenclature cooperated during the year in the preparation of the report of the national committee on horticultural nomenclature. This will be a valuable publication.

An active interest was taken in pressing the passage of a uniform package law. This has passed the House of Representatives, but has not yet been acted on by the Senate.

Correspondence has been had with the Secretary of Agriculture and a statement of his interest in further cost-of-production studies received.

During the year between sixty thousand and seventy thousand pieces of printed or typed mail have been sent out from the Secretary's office. Cooperation from the agricultural editors has meant that the society has had mention one or more times in practically every farm paper in this country. All this publicity is serving to bring the Society to a public attention which it has never before had.

The membership now stands as follows: Life, 134; Annual, 318; Collegiate, 73; Society, 14; Institutional, 65, making a total of 604. This is nearly 100 more than last year.

The following deaths have been reported: Mr. G. Harold Powell and Dr. J. C. Whitten of California, both serving as members of our Executive Committee; Prof. John C. Stewart of Pennsylvania, a life member and former executive committeeman, and Prof. S. A. Beach of Iowa.

Your Secretary feels that considerable progress has been made during the year in developing the American Pomological Society again into an active functioning and useful organization, in bringing to it a recognition of its field of endeavor and position of authority in pomological matters, and in making it known to thousands of fruit growers who have not heard of it before.

This has been possible through the enthusiastic work of a set of officers and executive committee men who have given liberally of their time and effort and through the interest of fruit growers in many states and their willingness to enlist.

Respectfully submitted,

R. B. CRUICKSHANK,
Secretary.

MEMBERS

Life

Alexander, M. D. ... Address unknown
Alwood, Wm. B. ... Greenwood, Va.
Ash, John ... Pomfret Center, Ct.
Atkins, Chas. G. ... Bucksport, Me.
Austin, C. F. ... Herradura, Cuba

Babcock, J. Lyman ... Norfolk, Va
Bailey, L. H. ... Ithaca, N. Y.
Berryhill, J. G. ... 304 New Call Bldg., San Francisco, Cal.
Black, Chas. ... Hightstown, N. J.
Blackmore, John C. ... 11 Ayr St., Lower Riccarton, Christ Church, Canterbury, N. Z.
Blair, J. C. ... Urbana, Ill.
Briggs, G. R. ... Plymouth, Mass.
Bunyard, E. A. ... Allington, Maidstone, Eng.

Chase, Howard, A. ... Commonwealth Bldg., Mount Pocono, Pa.
Cane, Mrs. Moses H. ... Blowing Rock, N. C.
Cook, David C. ... Elgin, Ill.
Crandall, C. S. ... Urbana, Ill.
Coe, Asher M. ... North Olmstead, O.
Chase Bros. Co. ... Rochester Nurseries, Rochester, N. Y.
Cruickshank, R. B. ... O. S. U., Columbus, O.

Darrow, Geo. M. ... U. S. D. A., Washington, D. C.
Dean, M. L. ... Department of Agriculture, Boise, Idaho
Dearing, Chas. ... U. S. D. A., Washington, D. C.
Devitt, Wm. ... Georgetown, Del.
Devol, Wm. Stowe ... Address unknown
Dewey, Geo. W. ... Address unknown
Dreer, W. F. ... Philadelphia, Pa.
Dumas, J. L. ... Pomona Ranch, Dayton, Wash.
Durell, E. H. ... Woodbury, N. J.
De Cou, Howard F. ... Moorestown, N. J.

Egbert, Knott C. ... Route 7, Tiffin, O.

Fay, Jesse B. ... 1021 Society for Savings Bldg., Cleveland, O.
Fletcher, W. F. ... Address unknown
Fraser, Samuel. ... Geneseo, N. Y.
Fugazzi, John F. ... Cincinnati, O.

Gammon, C. W. ... 67 7th Ave., New York City
Gardiner, Robt. H. ... Gardiner, Me.
Garfield, Chas. W. ... Grand Rapids, Mich.
Gay, Leslie F. ... Station A, Los Angeles, Cal.
Gerrish, O. K. ... Lakeville, Mass.
Gillett, M. E. ... Tampa, Fla.
Greening, Chas. E. ... Monroe, Mich.
Green, E. C. ... 1101 W. Green St., Urbana, Ill.
Guilford, W. S. ... Orland, Cal.

Hansen, N. E. ... Brookings, S. D.
Harrison, Orlando ... Berlin, Md.
Hart, W. S. ... Hawks Park, Fla.
Hartevelt, A. ... Ryswick, by den Haag, Holland
Hodge, C. F. ... Clark University, Worcester, Mass.
Hume, H. Harold ... Glen St., Mary, Fla.
Hunnewell, Walter ... 87 Milk St., Boston, Mass.
Husmann, Fred L. ... Second and Seminary Sts., Napa, Cal.

Husman, Geo. C.....U. S. D. A., Washington, D. C.
Herff, B. Von.....Eden Hotel, Zuerich, Switzerland

Ilgenfritz, Chas. A.....Monroe, Mich.
Irish, H. C.....Route 6, Webster Grove, Mo.

Kains, M. G.....Pomona, N. Y.
Kidder, N. T.....Milton, Mass.
Kirkpatrick, T. J.....1603 High St., Springfield, O.

Lake, E. R.....2033 Park Road, N. W., Washington, D. C.
Lauman, G. N.....Ithaca, N. Y.
Lehenbauer, P. A.....University of Nevada, Reno, Nev.
Leslie, W. R.....Dominion Experiment Farm, Morden, Manitoba, Can.
Lewis, K. B.....Red Hook, N. Y.
Lysle, Addison.....Address unknown

Magid, Louis B.....Tallulah Park, Ga.
Manu, Chas. W.....U. S. D. A., Washington, D. C.
Marshall, Geo. A.....Arlington, Neb.
Mayer, Dr. H. J.....Willowstreet, Pa.
Meneray, F. W.....715 First St., Council Bluffs, Iowa
Miller, H. W.....Paw Paw, W. Va.
Minott, C. W.....964 Main St., Melrose Highlands, Mass.
Morris, O. M.....Pullman, Wash.
Munson, D. O.....Address unknown
Myers, Wm. S.....25 Madison St., New York City
McAfee, H. B.....Adress unknown
McLaughlin, Henry.....Bangor, Me.

Neame, F. Ivo.....Macknade, Faversham, Eng.
Niagara Sprayer Co.....Middleport, N. Y.

Perrine, W. S.....Centralia, Ill.
Phillips, J. L.....Linden, Va.
Price, H. L.....Blacksburg, Va.
Pershing, Thed.....Pineville, Pa.
Pease, J. L.....Apartado Postal No. 2843, Mexico City, Mex.
Pratt, B. G. Co.....50 Church St., New York City

Quaintance, A. L.....U. S. D. A., Washington, D. C.

Reom, J. A.....Paradise, Butte County, Cal.
Richardson, Chas. E.....Address unknown
Roeding, Geo. C.....Fresno, Cal.
Rogers, A. J.....Beulah, Mich.
Rowe, Geo. E.....Address unknown
Rust, David.....606 Finance Bldg., Philadelphia, Pa.
Riehl, E. A.....Godfrey, Ill.
Reed, W. C. & Son.....Vincennes, Ind.

Sadler, Dr. O. W.....Bradentown, Fla.
Sampson, F. G.....Quincy, Fla.
Schenck, A. A.....1731 Columbia Road, Washington. D. C.
Smith, Wm. Elliot.....Alton, Ill.
Smith, Geo. W.....Hartford, Conn.
Smith, Erwin F.....1457 Stoughton St., Washington, D. C.
Smith, John D., Jr.....Tipton, Ind.
Smith, Wing R.....226 Wieting Bldg., Syracuse, N. Y.
Stark, Wm. H.....30 Wayne Ave., White Plains, N. Y
Starr, Robt. W.....Wolfville, N. S., Canada
Streator, Geo. J.....854 Seaside Ave., Santa Cruz, Cal.
Swineford, Howard.....617 Mutual Bldg., Richmond, Va.

Swingle, W. F.....U. S. D. A., Washington, D. C.
Smith, J. E.....Wysor Bldg., Muncie, Ind.

Taber, G. L.....Glen St., Mary, Fla.
Taylor, F. W.....3939 W. 7th St., Los Angeles, Cal.
Taylor, Wm. A.....1315 Gallatin St., N. W., Washington, D. C.
Temple, W. C.....Winter Park, Fla.
Thomas, Mrs. Anna V. G.....Kingston, R. I.
Thompson, J. B.....Guam, Guam
Trelease, Wm.....University of Illinois, Urbana, Ill.
Templin, M. B.....Canfield, O.
Toledo Rex Spray Co.....Toledo, O.

Ward, C. W.....Box 48, Eureka, Cal.
Warren, J. R..Marathon 23, Seymour Gr., Camberwell, Victoria, Australia
Watson, B. M.....Plymouth, Mass.
Weber, Frank A.....Nursery, St. Louis, Mo.
Wister, P. J.....Manilla, P. I.
Whitworth, J. A.....527 Crescent Ave., Grand Rapids, Mich.
Wickersham, Robt. A.....Benderville, Pa.
Wilder, Edward B.....Dorchester, Mass.
Wilder, H. J.....U. S. D. A., Washington, D. C.
Williams, J. L.....Address unknown
Wilson, Silas.....Nampa, Idaho
Wister, John C.....Germantown, Pa.

Annual

Albyn, H. A.....The Orchards, Bennington, Vt.
Archbold & Co.....Waterport, N. Y.
Adams, Herbert.....131 W. 11th St., New York City
Alderman, W. H.....University Farm, St. Paul, Minn.
Anthony, R. D.....State College, Pa.
Adams, W. B.....Route 2, Worthington, O.
Anderson, F. W.....2525 Tulane St., Fresno, Cal.

Buchannan, H. L.....Route 10, Logansport, Ind.
Bingham, C. A.....404 Erie Bldg., Cleveland, O.
Berckmans, L. A.....Herald Bldg., Augusta, Ga.
Blessing, David S.....Box 1175, Harrisburg, Pa.
Brown, C. H.....Swedesboro, N. J.
Babcock, E. B.....College of Agriculture, Berkeley, Cal.
Bioletti, F. F.....University of California, Berkeley, Cal.
Brill, G. D.....Jamesburg, N. J.
Benson, E. F.....Care N. P. Ry., St. Paul, Minn.
Bangher, H. G.....Aspers, Pa.
Bonner, R. E.....Lenox, Mass.
Buxton, B. C.....Middletown Springs, Vt.
Bolster, Wilfred.....40 Babcock St., Brookline 47, Mass.
Beauman, Guy.....Tunnel Hill, Ill.
Brimble-Combe, Wm., M. D.....Carmi, Ill.
Bailey, J. S.....Ames, Iowa
Barker, C. W.....Exeter, N. H.
Brazelton, Meck.....Troy, Kan.
Blaisdell, A. L.....Winterport, Me.
Beal, Dr. E. L.....Republic, Mo.
Brown, H. L.....Waterport, N. Y.
Bryant, A. W.....Princeton, Ill.
Bureau of Plant Industry....Department of Agriculture, Harrisburg, Pa.
Buchanan, A. L.....Logansport, Ind.
Billingsley, B. L.....Greenwood, Ind.
Bailey, Claude.....Burnt Hills, N. Y.

Barr, Jas. W.....Keswick, Va.
Burrage, C. H.....33 Broadway, Asheville, N. C.
Baird, W. C.....Ashtabula, O.
Byers, E. E.....Flora, Ill.
Brown, F. C.....Westerville, O.
Bechtel, Theo.....Ocean Springs, Miss.
Bowman, M. L.....Route 2, Box 71, N. Baltimore, O.
Browne, M. W.....3103 Coleman Road, Kansas City, Mo.
Bullard, T. E.....Schuylerville, N. Y.

Cannaday, Dr. J. E.....
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Clark, R. M.....Apple Grove Orchard, Des Moines, Iowa
Crawford, Wm.....Orange County, Monroe, N. Y.
Clemons, C. F. L.....Route 7, Davenport, Iowa
Cecil, M. A.....8018 Grace Ave., S. W., Cleveland, O.
Close, C. P.....College Park, Md.
Caha, Wm.....Wahoo, Neb
Clarke, M. D.....Green St., Starkville, Miss.
Chilcott, A. H.....Vienna, Va.
Cort, J. Elliot.....1880 Linda Vista Ave., Pasadena, Cal.
Crofts, John McD.....Linlithgo, N. Y.

Dawson, W. P.....Aurelia, Iowa
Doyle, E. F.....175 Franklin St., New York City
Douglas, B. W.....Hickory Hill, Trevlac, Ind.
Durst, C. E.....Arlington Heights, Ill.
Dickinson, Dr. B. M.....5634 Stanton Ave., Pittsburgh, Pa.
Dunlap, H. M.....Savoy, Ill.
Dyer, John N.....McKinney Farms, Vincennes, Ind.
Downing, Jas.....Andover, Mass.
Dexter, C. O.....115 Orchard St., New Bedford, Mass.
Dow, H. H.....Dow Chemical Co., Midland, Mich.
Day, L. O.....West Liberty, Ill.
Dutton, C. A.....Galesville, Wis.
Daeumler, Pastor Chr.....715 Atlanta Ave., Webster Grove, Mo.
Dickson, W. M.....Woodside, Del.

Etherton, Jas. M.....Carbondale, Ill.
Endicott, R. B.....Villa Ridge, Ill.
Eckert, A. O.....Bellville, Ill.
Ellston, J. C.....Exeter, Mo.
Elder, G. K.....Lewiston, Me.
Etter, A. F.....Ettersburg, Cal.
Eames, H. F.....Egg Harbor, Wis.

Farnsworth, W. W.....Waterville, O.
Finley, Milton A.....R. 1, Rochester, N. Y.
Forkert, C.....Ocean Springs, Miss.
Freeborn, Mrs. Mary.....Proctor, Vt.
Farrand, T. A.....M. A. C., E. Lansing, Mich.
Foster, H. S.....North Calais, Vt.
Ford, A. E.....1408 Callowhill St., Philadelphia, Pa.
Felter, H. L.....Washta, Ia.
Fullerton, H. B.....Medford, Long Island, N. Y.
Farley, J. N.....Hutchison, Kan.
Fiebing, J. H.....238 Reed St., Milwaukee, Wis.
Funk, H. W.....Normal, Ill.
Feldman, J. J.....Kahoka, Mo.
Fancher, E. S.....Middletown, N. Y.
Faxon, Richard.....Div. of Plant Industry, Columbus, Ohio.

Flohr, L. B.....Vienna, Va.
Fairchild, David.....Dept. Agr., Washington, D. C.
Fuson, R.....R. 1, Box 41, Boguechitto, Miss.

Gould, H. P.....U. S. D. A., Washington, D. C.
Gordon, Silvanus.....Sergeantsville, N. J.
Goff, M. B.....Sturgeon Bay, Wis.
Green, F. M.....B. 374, Hood River, Ore.
Good, E. H.....B. 322, Peru, Neb.
Gill, R. A.....R. 3, Port Clinton.
Garrett, F. B. & Sons.....Burns City, Ind.
Goodale, G. D.....258 Beacon St., Boston, Mass.
Grasselli Chem. Co.....Cleveland, Ohio.
Gage, J. P.....Vineland, N. J.

Hoddy, E. J.....L. & N. R. R., Knoxville, Tenn.
Harris, Walter B.....Worton, Md.
Hubbard, T. S. Co.....Fredonia, N. Y.
Hinds, Rollin E.....Hedrick, Ia.
Holbrook, F. C.....Scott Farm, Brattleboro, Vt.
Hall, A. I.....Rochester, N. H.
Hulett, G. A.....West St., Antrim, N. H.
Harrington, F. O.....Williamsburg, Iowa.
Holland, C. S.....Agl. Ext., Ames, Iowa.
Hinkley, H. O.....Alma, Ill.
Hathaway, H. W.....Portsmouth, R. I.
Holt, Austin.....Wilton, N. H.
Hyland, J. H.....B. 312, Attleboro, Mass.
Hatch, L. M.....Alberton, Wash.
Hale, R. H.....Omaha, Ill.
Hommel, R. S.....Care Daniel Briscol Co., Knoxville, Tenn.
Hollstein, Geo.....R. 2, Amherst, Ohio.
Hellenmeyer, L. E.....Lexington, Ky.
Houghton, D. D.....Dalton, Ohio.
Higgins, C. W.....1819 E. 6th St., Duluth, Minn.
Hitchcock, C. W.....1308 Williamson Bldg., Cleveland, Ohio.
Hale, J. O.....Byfield, Mass.
Howard, Hickory Co.....Hickory, N. C.
Hoffman, Max.....R. 2., St. Joseph, Mich.
Haines, Robt. B.....130 Main St., Moorestown, N. J.

Ivins, M. H.....Langhorne, Pa.
Ink, J.....Canton, Ohio.
Ivorys, Limited.....B. 834, Christchurch, New Zealand.

James, Carl B.....Montgomery, Ala.
Johnson, Dr. B. & Son.....Mooresville, Ind.

Kluever, E.....420 Columbia Bldg., Cleveland, Ohio.
Kluck, N. A.....Lena, Ill.
Kipp, R. H.....R. A. Watson Orchard, Valley, Ill.
Kent, L. E.....Poway, Cal.
Kent. E. W.....202 Boulevard Ave., Mexico, Mo.
Kleiderver, C. F.....Henderson, Ky.
Kinsella, A. J.....2613 Ashland St., Cincinnati, Ohio.

Ledoux, Wm. H.....Grand Isle, Vt.
Lawlor, F. J.....B. 127, Pittsford, N. Y.
Locklin, H. D.....B. 637, Grand Junction, Colo.
Leeson, J. R.....91 South St., Boston, Mass.
Lewis, S. R.....Mountainville, N. Y.

Lodge, W. F.....Monticello, Ill.
Lewis, C. I.....53 W. Jackson Blvd., Chicago, Ill.
Latimer, L. P.....Univ. of Cal., Berkeley, Cal.
Leonard Coates Nursery Co.....Morganhill, Cal.
Lovett, L. C.....Little Silver, N. J.
Livingston, P. I.....R. 1, Lowell, Mass.
Longanecker, E. L.....Canfield, Ohio.

Mount Arbor Nurseries.....Shenandoah, Iowa.
Mayer, Guy S.....Willowstreet, Pa.
Meder, O. F.....B. 8, R. 1, Westwood, N. J.
Miles, H. C. C.....Milford, Ct.
Moses, Arthur.....Unionville, Ct.
Minor, Don. E.....400 4th Natl. Bank Bldg., Grand Rapids, Mich.
Merrill, A.....Mulberry Grove, Ill.
Mottaz, R. W.....725 Wainwright Bldg., St. Louis, Mo.
Myers, W. S.....25 Madison Ave., N. Y. City.
Maplehurst Fruit Farm.....Pittsfield, N. H.
Meissner, Henry.....Leighton, Iowa.
Mathews, C. W.....660 S. Limestone St., Lexington, Ky.
Munson Nurseries.....Denison, Texas.
Mason, A. F.....State Agri. College, New Brunswick, N. J.
Marken, R. L.....Gays Mills, Wis.
Main, E. L.....126 W. Winter St., Delaware, Ohio.
Mathews, C. N.....Chillicothe, Mo.
Morse, A. A.....Williamson, N. Y.
Marble Laboratory, Inc.....Rockgirt Orchards, Canton, Pa.
Mechling, E. A.....Moorestown, N. J.
McKinney, G. F.....Tymor Farm, La Grangeville, N. Y.
McKinstry, David.....Kankakee, Ill.
MacGregor, G. R. D.....Franklin, Mass.
McPike, E. F.....135 E. 11th Pl., Chicago, Ill.

Newberry, W. F.....233 Broadway, N. Y. City.
Niles, Ben E., Secy.....Ky. State Hort. Society, Henderson, Ky.
Nicol, Jas.....South Haven, Mich.
Niles, P. A.....Missouri Valley, Ia.
Namikawa, Dr. Isawo.....
...Care Japanese Consulate Gen., 1 Broad St. Pl., London, E. C., Eng.
Neosho Nurseries Co.....Neosho, Mo.

Odell, F. I.....Cannelton, Ind.
Ordway, C. D.....207 S. Union St., Burlington, Vt.
Otis, G. T.....Bangor, Mich.

Platt, Norman S.....395 Whalley Ave., New Haven, Ct.
Palmer, D. B.....Milton, N. Y.
Parrish, C. A.....316 W. Morrell St., Jackson, Mich.
Perry, Margaret.....Hancock, N. H.
Porter, C. R.....Rome, Ga.
Peacock, N. D.....Univ. of Tenn., Knoxville, Tenn.
Peters, R. B.....Devore, Cal.
Parker, H. B.....Fiskdale, Mass.
Paddock, W.....O. S. H., Columbus
Prairie Nurseries, Ltd.....Estevan, Sask., Canada.
Phillips, R. G.....522 Mercantile Bldg., Rochester, N. Y.

Quak-Al-Nunk Orchards.....R. 3, Delta, Pa.

Reed, W. C. & Sons.....Vincennes, Ind.
Roesch, Lewis.....Fredonia, N. Y.
Richie, A. L.....Riverton, N. J.

Ringhausen, Chris.....Hardin, Ill.
Robertson, John.....Hot Springs, S. D.
Roberts, R. H.....Madison, Wis.
Ralph, D. A.....North Attleboro, Mass.
Rodgers, R. W.....Lockland, Ohio.
Russel, Robbins.....Thermal, Cal.
Reeves, E. M.....Waverly, Ia.
Reed, C. L.....West Newbury, Mass.
Robertson, R. R.....Norwalk, Ohio.
Ring, M. A.....Conneaut, Ohio.
Roberts, Emmor.....Moorestown, N. J.
Rubicon Realty Co.....226 S. Ludlow St., Dayton, Ohio.

Stafford, Irving B.....848 Ackerman Ave., Syracuse, N. Y.
Simpson Orchard Co.....Vincennes, Ind.
Shattuck, F. E.....Princeton, Ky.
Stanton, J. W.....Richview, Ill.
Schwartz, Frank.....Tilford & Schwartz, Salem, Ill.
Stark, P. C.....Louisiana, Mo.
Schwietert, H. J.....135 E. 11th Pl., Chicago.
Sharp, James.....Council Grove, Kan.
Stites, Wm. H.....Henderson, Ky.
Snyder, S. W.....Center Point, Ia.
Spaulding, R. L.....Villa Ridge, Ill.
Stevensville Nurseries.....Stevensville, Mich.
Smith, G. L.....
Mid-W. Landscape & Orch. Serv., Crandall Transfer Bldg, Moline, Ill.
Swaim, H. H.....Ind. Hort. Society, Lafayette, Ind.
Stephens, E. F.....B. 147, Nampa, Ida.
Simpson, F. H.....Flora, Ill.
Shook, W. R.....Rittman, Ohio.
Shaw, R. N.....18 Oliver St., Boston, Mass.
Seabrook & Sons, W. Ltd.....Chelmsford, Can.
Sharp, M.....Vaccaville, Cal.
Storrs & Harrison Co.....Painesville, Ohio.
Smith, I. C.....1210 Ellis Ave., Ashland, Wis.
Sandsten, E. P.....Dept. Hort. Colo. Agr. College, Ft. Collins, Colo.
Smith, G. E.....28 Platt St., Albion, N. Y.
Schauber, G. R.....Ballston Lake, N. Y.
Schroeder, H. J.....Barclay Hts., Saugertus, N. Y.
Schultz, E. B.....Laurel, Ind.
Scarff, H. F.....New Carlisle, Ohio.

Thew, M. E.....Arthursburg, N. Y.
Thayer, John E.....George Hill Rd., Lancaster, Mass.
Tyrrell, J. B.....14 Walmer Rd., Toronto, Can.
Thornburg, T. E.....Ashland, Ohio

Underwood, D. B.....Harveysburg, Ohio.
Underdown, W. E.....Ann Arbor, Mich.

Van Cleve, A. D.....R. 5, Lockport, N. Y.
Voris, L. K.....Neoga, Ill.
Van Antwerp, H.....Farmers, Ky.
Veeder, L. B.....Baldwin, Ga.

Wite-Adler Fruit Farms.....955 Harvard St., Rochester, N. Y.
Whisker, A. L.....Grass Valley, Cal.
Westcourt, F. W.....John Tarleton Agr. Col., Stephensville, Texas
Wilson, F. M.....Williamstown, Mass.
Willhite, Jas. Jr.....R. 1, Temperance, Mich.
Weinberg Bros.....Galesburg, Ill.

Williams, L. C.....Manhattan, Kan.
West, E. H.....Dorset, Vt.
Wertz, D. M.....Grant and King Sts., Waynesboro, Pa.
Wickersham, R. A.....528 N. Marengo Ave., Pasadena, Cal.
Wood, E. M.....North Madison, Wis.
Warner, J. H.....Hampton Farms, Poughkeepsie, N. Y.
Waite, J. W.....B. 307, Normandy, Tenn.
Weicksel, Dr. Amelia.....R. 1, Perkasie, Pa.
Washington Nurseries Co.....Toppenish, Wash.
Wood, A. L.....891 Garson Ave., Rochester, N. Y.
Wright, J. B.....Cairo, Ga.
Willis Nurseries.....5th St., Ottawa, Kan.
Wadsworth, Mrs. W. A.....Geneseo, N. Y.

Young, W. E.....Waterville, Ohio.

Zimmerman, F. S.....Chelan, Wash.

Collegiate.

New Hampshire.
Warren Whitcomb.....Durham
A. N. Laurence..... "
H. A. Rollins..... "
A. L. French..... "

SOCIETY.

Ohio State Hort. Society, Secy., R. B. Cruickshank, O. S. U., Columbus.
New Jersey State Hort. Society, Mount Holly, N. J.
Northern Nut Growers' Assn., 607 Main St., Hartford, Conn.
S. W. Iowa Hort. Society, Secy., A. E. Rapp, R. 1, Council Bluffs, Iowa.
New York Hort. Society, Exeter, N. H.
New York State Hort. Society, LeRoy, N. Y.
Northumberland & Durham Apple Association, Brighton, Ontario, Canada.

30-Year Institutional.

Alabama Polytechnic Institute, 1904-1934, Auburn, Ala.
Luther Burbank Press, 1912-1942, Santa Rosa, Cal.
California State Univ. Libr., 1913-1943, Berkeley, Cal.
Central Exp. Farms, 1899-1929, Ottawa, Canada.
Citrus Experiment Station, 1912-1942, Riverside, Cal.
Colorado State Agr. Library, 1904-1934, Ft. Collins, Colo.
Crerar Library, The John, 1909-1939, Chicago, Ill.
Detroit Public Library (1921-1950), Detroit, Mich.
Georgia State College of Agr. Library (1915-1945), Athens, Ga.
Georgia State Univ. Library (1911-1941), Athens, Ga.
Hardie Co., H. H., 1921-1951, Hudson, Mich.
Illinois State Univ., Hort. Dept., 1908-1938, Urbana, Ill.
Iowa State College Library, 1902-1932, Ames, Iowa.
Kansas State Hort. Society, 1897-1927, Topeka, Kansas.
Kansas Agr. College Library, 1914-1944.
Maine State Exp. Sta. Library, 1906-1936, Orono, Me.
Maine State Univ. Library, Orono, Me., 1909-1939.
Maryland Agr. Exp. Sta. Library, 1905-1935, College Park, Md.
Massachusetts Agr. College Library, 1910-1940, Amherst, Mass.
Massachusetts Fruit Growers' Assn. Library, 1914-1940, Marlboro, Mass.
Michigan Agr. College Library, 1872, East Lansing, Mich.
Minnesota Agr. Exp. Sta. Library, 1899-1929, St. Anthony Park, Minn.
Mississippi State Agr. College Library, 1900-1930, Agri. College, Miss.

Missouri Fruit Exp. Sta., 1901-1931, Mountain Grove, Mo.
Missouri State Hort. Society, 1897-1927, Columbia, Mo.
Missouri State Univ. Library, 1898-1928, Columbia, Mo.
Montana State Board of Hort., 1911-1941, Missoula, Mont.
Montana Exp. Sta. Library, 1904-1934, Bozeman, Mont.
Nebraska State Univ. Library, 1914-1944, Lincoln, Neb.
New Hampshire State Library, 1901-1931, Concord, N. H.
New Mexico A. & M. College Library, 1904-1934, Mesilla Park, N. M.
New York State Exp. Sta. Library, 1900-1930, Geneva, N. Y.
New York State Library, 1900-1930, Albany, N. Y.
North Carolina College of Agr., 1908-1938, West Raleigh, N. C.
Stark Orchards & Nursery Co., 1921-1951, Louisiana, Mo.
North Carolina Dept, of Agr., 1907-1937, Raleigh, N. C.
Ohio State Univ. Library, 1912-1942, Columbus, Ohio.
Ohio Agr. Exp. Sta., 1889.
Ontario Agr. College Library, 1902-1932, Guelph, Ontario, Can.
Oregon Agr. Exp. Sta., 1907-1937, Corvallis, Ore.
Oregon State Agr. Exp. Sta., 1912-1942, Talent, Ore.
Package Sales Corp., 1922-1952, South Bend, Ind.
Purdue Univ. Library, Lafayette, Ind., 1912-1942.
Purdue Univ. Exp. Sta., Lafayette, Ind., 1912-1942.
Rhode Island Exp. Sta. Library, Kingston, R. I.
Riverside Public Library, 1915-1945, Riverside, Cal.
Sapporo Agr. College, 1904-1934, Sapporo, Hokkaido, Y. Hoshino, Japan.
Stark Orchards & Nursery Co., 1921-1951, Louisiana, Mo.
Texas Agr. College Library, 1906-1936, College Station, Texas.
Toledo Rex Spray Co., Toledo, 1922-1952.
Library, Univ. of State of New York, 1920-1950, Albany, N. Y.
Univ. of Cal. Agr. Library, 1913-1943, Berkeley, Cal.
Vermont Agr. Exp. Sta., 1906-1936, Burlington, Vt.
Virginia Polytechnic Institute, 1907-1937, Blacksburg, Va.
Washington Agr. College Library, 1907-1937, Pullman, Wash.
West Virginia Univ. Library, Morgantown, W. Va., 1913-1943.
West Virginia Agr. Exp. Sta., 1913-1943, Morgantown, W. Va.
Wild & Bros., James B., 1904-1934, Sarcoxie, Mo.
Wisconsin State Univ. Library, 1904-1934, Madison, Wis.
Worcester County Hort. Society, 1911-1941, Worcester, Mass.
Wyoming State Univ. Library, 1899-1929 (extended 1 year), Laramie, Wyo.
State Univ. Library, Lincoln, Neb., 1913-1943.

Above photo—three-year-old Stark's Golden Delicious tree bearing 147 apples in A. Johnson's orchard, Rogue River Valley, Ore.

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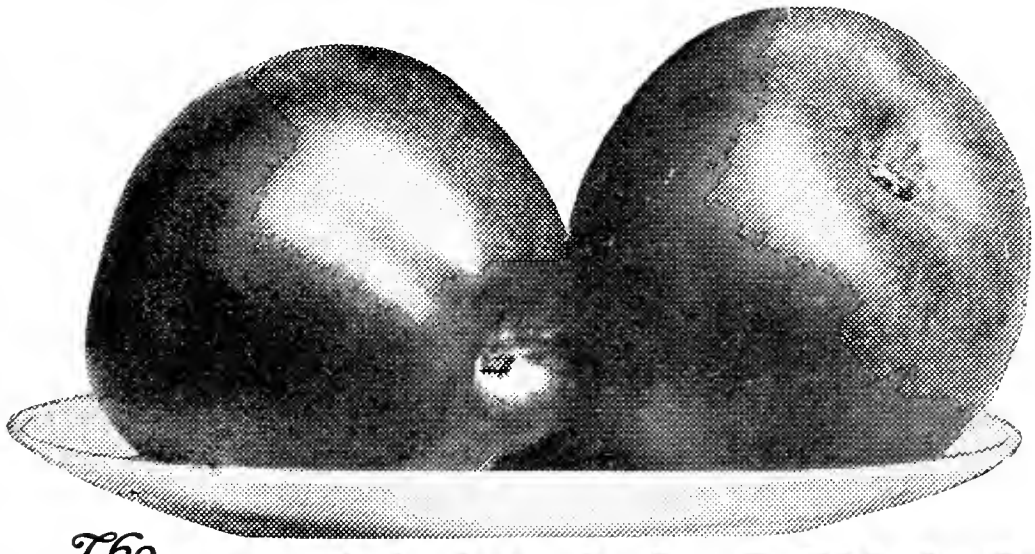

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