ANNUAL REPORT

OF THE

Fruit Growers' Association

OF

ONTARIO

1912

District Representative
Petrolia

FORTY-FOURTH ANNUAL REPORT

OF THE

Fruit Growers' Association

OF

Ontario

1912

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.)

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To His Honour SIR JOHN MORISON GIBSON, Knight Commander of the Most Distinguished Order of St. Michael and St. George, a Colonel in the Militia of Canada, etc., etc., etc.,

Lieutenant-Governor of the Province of Ontario.

MAY IT PLEASE YOUR HONOUR:

I have the honour to present the Forty-fourth Annual Report of the Fruit Growers' Association of Ontario.

Respectfully submitted,

JAMES S. DUFF,
Minister of Agriculture.

DEPARTMENT OF AGRICULTURE,
TORONTO, 1913.

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Fruit Growers' Association of Ontario.

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Vice-President.....ROBT. THOMPSON, St. Catharines.
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COMMITTEES:

Transportation: A. ONSLOW, Niagara; GEO. FRENCH, Sarnia; ELMER LICK, Oshawa; W. J. BRAGG, Bowmanville.

Co-operation: JOS. GILBERTSON, Simcoe; R. S. DUNCAN, Port Hope; LORNE CAREY, Hamilton; W. J. SAUNDERS, East Linton.

New Fruits: W. T. MACOUN, Ottawa; PROF. J. W. CROW, Guelph; F. S. REEVES, Vineland Station.

Historical: A. MCNEILL, Ottawa; W. T. MACOUN, Ottawa.

FINANCIAL STATEMENT, 1912.

Receipts.		Expenditures.	
Balance on hand Dec. 31, 1911	$1,945 13	Annual Meeting	$338 50
Members' fees	469 99	Committees	298 75
Show:		Periodicals	591 60
Entry fees	180 05	Printing	20 75
Fruit sold	1,166 95	Postage	100 00
Grant	1,700 00	Show	1,520 92
Interest	71 08	Grants	300 00
		Miscellaneous	688 25
		Balance on hand	1,674 43
	$5,533 20		$5,533 20

(Signed) D. Johnson,
President.
P. W. Hodgetts,
Treasurer.

Audited this 13th day of January, 1913.

(Signed) D. F. Cashman,
Auditor.

Fruit Growers' Association of Ontario

ANNUAL MEETING.

The fifty-third annual meeting of the Fruit Growers' Association of Ontario was held in Toronto on November 13th, 14th, and 15th, 1912.

At ten o'clock a.m. on Wednesday, November 13th, 1912, PRESIDENT D. JOHNSON, of Forest, called the meeting to order and said:

PRESIDENT'S ADDRESS.

D. JOHNSON, FOREST.

We have again gathered at our annual meeting to discuss matters of interest to us all. The season, that is now fast drawing to a close, has had its advantages and disadvantages. The extremely cold winter through which we passed has affected some of us seriously, but generally speaking, the season has been quite above early expectations. The great awakening that has taken place during the last few years in the scientific care of orchards, has born fruit in many districts that formerly produced little or no fruit. The campaign of education to the producer has shown its value, and many orchards which were formally an eye sore and a disgrace to the farm on which they stood are now its pride and delight. Not only are farmers showing greater interest in their orchards now planted, but they are planting out apple, peach, pear, and plum trees as never before. So great is the interest of all classes in fruit growing and so rapidly is the area of orchards increasing, that it is very important that it should be guided along the best and most substantial lines.

We must produce such fruit as the demands call for, and our plantings should be such as would reap the reward of the future. In the apple season that is now on, we find that for certain varieties of apples there appears to be an unlimited demand. Such varieties as the Spys, Snows, McIntosh Red and King are in great demand at prices ranging from $3.50 to $4.00 per barrel at shipping point; while the Ben Davis, Baldwins and Greenings are almost a drug on the market, and moving slowly at $2.25 per barrel.

The great markets of the West and North are prepared to pay a proper price for what they want and we, as producers, should plant according to their demand. So enormous has been the planting of orchards this last few years that we are forced to face the question of over-production. That question has been the nightmare of the fruit grower as long as I can remember, and it looks to me that perhaps at some distant time over-production may come upon us, but, I believe, and firmly believe, that there is no danger of over-production as long as we produce that which the public demands, and drop the idea of trying to force the public to adopt the varieties and grades that we would like them to adopt.

I have noticed this season, with some alarm, that the Ontario apples are being driven out of the West to a very great extent by the competition of Western growers

and shippers. Our salesman has informed me that the Provinces of Alberta and Saskatchewan are using largely Western apples, and that, in spite of the most earnest efforts of Ontario salesmen the preference is given to Western apples on account of their superior pack. They will all admit that in flavor our apples far surpass them, but owing to the uncertainty of the Ontario pack, they are obliged to purchase in other places to protect themselves.

Thus, it is beyond doubt, a fact that we must produce a high quality of apples and a high grade of pack.

Western Ontario has this season a fair crop of apples, much larger than they have had for some years, and, I regret to say, that I believe fully 25 per cent., perhaps more, of the fruit has gone to waste. Some has been taken to the canning factories, some to the evaporators, but a large percentage has gone utterly to waste, and that which was bought by the buyers was bought at a price so discouraging to the grower that they have little or no heart to care for their orchards in the future.

It is a distressing fact that such conditions exist, and there is no reason why they should. The farmers themselves are largely to blame for any loss that they have had in that way, for by co-operating together they could have saved their fruit and made themselves good returns. The Department of Agriculture has worked hard to spread information regarding Co-operative Associations in many places, and in many places Associations have been organized and in almost every case they have met with success.

In my own County of Lambton some 40,000 barrels of apples have been handled in this way at prices ranging from $2.50 to $3.00 f.o.b., shipping point. While the apple crop has been large, yet, I am sure the entire crop could have been handled at good prices, but only through organization.

The peach crop of Ontario has been much larger than was at first expected. The cold winter had seriously hurt the buds in many places, but the crop was large and in some cases the fruit was allowed to go to waste. This again was not the fault of the market, but the lack of help and largely the lack of baskets, which shows the necessity of looking ahead and preparing for both labor and supplies.

It appears to me that an educational campaign of how to market fruit is now the crying need of the day. No matter how well we grow fruit, if we can't sell it there is no encouragement to produce.

We fruit growers are pleased indeed that the Dominion Government has made some advancements along lines suggested from this Association. Qualified fruit inspectors have been increased which has resulted in the better packing of fruit. A year ago we asked for inspection at point of shipment. To some extent we have been granted this, but in my opinion, it should be much more thorough than it now is. Inspectors should be not only inspectors, but instructors as well. If they find it necessary to mark down a package they should be able to explain the reason why.

The past season has been one of marked activity of the Transportation Committee; often at great inconvenience to themselves they have met and planned how to promote the better transportation of fruit.

Mr. G. E. McIntosh has been appointed to take up this work under their direction, and has entered into a very careful study of the questions. It appears to some of us that the carrying companies are anxious to get all the business they can from us, and give us no more accommodation than they can. Mr. McIntosh has

been quietly gathering facts, which we are sure will bring results. We are fortunate in having a Railroad Board to which we can appeal, and, if denied our rights, can lay our requests before them. Mr. McIntosh will make a report before you, so that it will be unnecessary for me to go into the details.

Referring again to the fruit inspectors, I would suggest that they also be made cargo inspectors. We fruit shippers feel that, after we have guarded our trees from planting to maturity, and the fruit from blossoming to the barrel that we should not be the only ones watched in the marketing of it. If we deliver the fruit, especially the tender fruit, into the hands of the transportation company, we feel that it is only right that the fruit inspectors, in the discharge of their duties in connection with the packing, should see that the transportation company handle our fruit in a manner to assure us the best delivery of it.

There is little encouragement in the shipping of tender fruit if it is going to be knocked about, destroyed, and rendered largely unsaleable in transit. Nor, do we feel easy about our shipments to Europe. We are told that everything that can be done is being done to market our fruit in good condition in those markets. Yet, the returns show so much depreciation on arrival that we well may ask the reason why.

We can ship apples to Calgary and far western points and, while our cars often do not travel faster than five miles an hour, yet, we seldom have trouble in landing them there in good condition.

Our transportation manager is trying to solve those problems, and we have every reason to believe will do so soon. During the past winter the Dominion Fruit Conference was held at Ottawa, where many questions of interest to the fruit growing industry were discussed. A number of resolutions were thrashed out and agreed to by the representatives of the various provinces, most of which, I regret to say, are apparently still on file. Whether they will be put in force yet remains to be seen. I can scarcely believe that any Government will be so blind to their duty as to fail to carry out the demands of the people, especially when those requests are presented by men in the foremost ranks of Canadian fruit growers and shippers, who have spent their life in working out the many problems of the industry, and who have nothing but the welfare of the fruit growing industry at heart.

Mr. Wm. Armstrong (Queenston): With reference to your point in regard to the transportation and handling of tender fruits, we as peach growers never suffered as much as we have done this year. It is simply ridiculous, and out of the question, for the growers to put up with it. Right here at Toronto is the greatest grievance of all, and why the citizens of Toronto have not concurred in our oft repeated enquiries with regard to a different market than the Scott Street market I am at a loss to understand. Certainly the time has arrived for something to be done. The fruit is thrown around and packed up ten or twelve tiers high The baskets with what we may call patent covers ought to be piled with a certain amount of discretion. When it comes to the patent cover it is really a shame to see how they are treated on arrival at the Yonge Street wharf. They are thrown down, and I am told, piled as high as eleven tiers. They have no room and no facilities. Sometimes there are not sufficient trucks to handle the business in the Niagara district. There were one or two occasions when the wharf at Niagara was covered completely and the boat left them there. They hadn't room for them even on the boat. That occurred once, if not more than once. Mr. Onslow could

speak more definitely as to Niagara, but I speak more particularly as to Queenston. The boat certainly did its best to give us accommodation, in fact it was the best accommodation we ever had, and yet they were not able to handle the business.

MR. W. H. BUNTING (St. Catharines): In the course of your address you have raised some very important points in connection with the fruit growing industry in this Province. I do not think we can take up these points intelligently, and deal with them as their importance deserves, in the limited time at our disposal, and I would suggest that a Committee be appointed to take up the matters that are of outstanding importance, to bring in a report during the progress of the Convention. If my suggestion meets with the approval of the meeting I would name Mr. W. F. W. Fisher, Mr. Kimmons, Mr. McIntosh, and Mr. Onslow as a committee to bring in a report on the President's address.

MR. L. A. HAMILTON seconded the resolution, which, after discussion, was adopted.

THE PRESIDENT: This is a very serious problem we are up against at the present time. Most of us who are present understand the production of fruit fairly well, but we find we have difficulties in marketing it, and one of the great problems in marketing is the transportation question, which Mr. McIntosh is making a special study of. There is very little encouragement in producing tender fruit if it is going to be knocked around the stations like old boots. We are sick and tired of the method of transportation, both of the railway companies and the express companies, and something must be done, and I am glad to hear the opinions that have been expressed.

MR. WHITE (Ottawa): I do not know whether it is known to the Committee, but it is a rare thing for a small shipment of peaches to arrive without some of it being stolen. In one case I had ten per cent. of a shipment stolen by the expressmen. That is a very serious matter, and it interferes very much with what would be a profitable business to the fruit grower. I mean the shipment of small lots to families. As it is, people are afraid they will never get them. In this case there were ten baskets of peaches sent to me by my brother. Two baskets were opened and over half of them stolen. I think if the Committee could bring pressure on the express companies they could stop it. It is a rare thing for any other kind of goods to arrive with a case broken open and part of them taken, but it is a regular thing with peaches.

THE PRESIDENT: They give you nothing but impudence. I think the Association is alive to the necessity of some action of that kind. We pack our fruit carefully and deliver it to the express companies as carefully as possible, but if they only take out one or two peaches it upsets the whole package. They are delivered probably in bad shape, and then they blame us for it, and we get into trouble. We are losing thousands and thousands of dollars every year. We do not mind paying for a thing if we get proper service.

MR. WHITE: If we had a wooden cover well fastened down there wouldn't be so much of it.

MR. BUNTING: While that point is up, we have Mr. Kimmins with us, Mr. Smith's confidential man, and probably no man ships more peaches on order than Mr. Kimmins. I would like him to state what his experience has been during the last year or two with reference to the point Mr. White has raised. My own experience has been that there has been a great improvement in the shipping of private orders to my customers, and out of several hundred orders this year I had

very few opened, probably not over a dozen, but I have had it where perhaps twenty-five per cent. of the shipments would be tampered with. I think in one of the express companies, with their new president, Mr. Pullen, we will get more satisfaction than we have had before in many respects.

MR. A. L. KIMMINS: I think possibly our customers have suffered to some extent in the way that Mr. White and Mr. Bunting have referred to, particularly when it comes to small customers in out of the way places. A great deal of our trade of course lies with the larger dealers in the larger towns, and usually it is coming in such volume that we do not hear anything about it. However, I must say the point that Mr. White refers to about the flimsy cover that we use over the peaches, and the flimsy manner in which they are attached to the basket, is in a large way responsible for the trouble. I think it is about time that somebody invented a basket that would answer our purposes, which would not run us into too great an expense. There have been complaints every year come in, which we have forwarded to the superintendent of the company, and I think they are just as anxious to put a stop to the pilfering as the fruit shippers, but it is a difficult matter for them to get at the party who takes the fruit. With a view of reaching the proper party we have advised all our customers to refuse to pay the shipment charges except by actual weight. As most of you know the express charges are assessed on the estimated weight, and if the baskets are full, as they should be, when they start out, there is very little difference in the estimated weight and the actual weight, but in case of pilfering there is always a difference, and if the customer rejects the shipment and agrees to pay on the actual weight it necessitates an enquiry into who handled the shipment, and they find out through whose hands the shipment passed. If the men get to know that the shipments which pass through their hands are liable to be traced back to them they are not so liable to help themselves to the fruit. I do not think it is so much the messengers as it is the fruit being allowed to stand around in the stations and transfer points where it is not properly protected and guarded. This is a matter which might well be taken up by the Association and dealt with for it is a source of constant trouble and irritation.

THE PRESIDENT: Apparently the managers of the express companies are anxious to place our fruit in as good condition as possible. We will grant that anyway, but their employees are not quite so anxious, and the result is we are suffering very seriously. Now, when we are packing peaches and plums we are responsible for the actions of our employees. If we do not pack our apples right our apples are turned down and we are liable to all kinds of trouble, and probably we are prosecuted in the courts. The transportation companies are responsible for the same thing if they do not look after their employees.

THE PRESIDENT: This question of transportation will come up later and I hope you will enter into a very free discussion of it.

THE CHAIRMAN: In the absence of Mr. Kimmins, who is chairman of the Special Committee, I will ask Mr. W. F. W. Fisher to make the report.

REPORT OF SPECIAL COMMITTEE.

We always find and expect to find any report made by our President brief but comprehensive. We find that he has dealt with a good many points on which this Committee felt it necessary to make recommendations. The Committee appointed to report on the President's address beg to offer the following suggestions:

1. In connection with that paragraph relating to the apparent loss of the western market to the Ontario fruit grower, we feel that there is still a very keen demand for Ontario fruit of all kinds, more particularly apples, as is shown by the enormous quantities shipped there this year, but a certain amount of trade has been lost owing to the western preference for box apples.

2. Your committee recommend that some steps should be taken to encourage the packing of apples in boxes to secure this trade. We suggest the establishment of packing schools during the winter months in connection with the Fruit Institutes. Some incentive to attend these, by the offering of prizes by this Association or by the Department of Agriculture is worthy of consideration.

We feel that this trade is too valuable to be lost for the want of adaptability on the part of our packers, to give the western people just what they want.

We would also suggest that if the Ontario Government place a special commissioner in the West during the ensuing season, that he be instructed and authorized to prosecute a rigorous educational campaign in favour of Ontario fruit, by judicious advertising and interviewing over the entire Provinces. In this way a demand for our fruits could be created in this vast market.

We cannot urge too strongly the absolute necessity of all apple packers raising the grade *above* the standard set by the Fruit Marks Act. It is a well known fact that sales have been lost owing to inferior packing in the past.

3. We think the remarks from the Chair about an educational campaign in connection with the distribution of fruit and other matters connected with that phase of the industry call for special attention at the hands of the Provincial Government.

Unfortunately those most heavily interested are extremely busy men and as any benefits accruing to an investigation of this kind are spread over the whole Province, we would recommend that a strong deputation from this Association wait upon the Ontario Government and request that a (Royal) Commission be appointed to thoroughly investigate all conditions relating to the fruit industry, including the production, distribution, transportation and consumption.

We feel that only in this way can the grievances of the fruit men be properly aired and remedies applied.

4. We would also recommend that further steps be taken to lay before the Dominion Minister of Agriculture the necessity of increasing the staff of fruit inspectors and that they be authorized to give a shipper a certificate for all shipments inspected at point of shipment.

We would also suggest that the sphere of these inspectors be enlarged so that they could prosecute under the Public Health Act, where shipments of fruit are offered that are unfit for consumption by reason of being over or under ripe.

We also feel that the scope of the Act might be enlarged to permit these inspectors to prosecute employees of transportation companies who carelessly injure shipments of fruit in transit. It is a well known fact that packages containing fruit, especially the more tender kinds, are subject to very rough usage which is just as injurious to the quality of the fruit as bad packing.

THE CHAIRMAN: Some of these suggestions are big enough to occupy a session in discussion. I am not sure whether you are prepared to pass them offhand or whether you wish to discuss them at this time, or whether you will have them laid over for future consideration. It is your privilege to deal with this report as you see fit.

The report was adopted.

OUR MOST TROUBLESOME ORCHARD INSECTS AND DISEASES.

L. Caesar, Provincial Entomologist, Guelph.

It was my intention, when I undertook to give this address, to illustrate the most important points about each insect or disease by means of lantern slides, because I thought that in this way the subject would be much more interesting and instructive and the main things of value more easily remembered. However, since it has been decided not to hold any evening meetings I shall have to do the best I can to make my meaning clear by means of charts.

Fig. 1.—Orchard defoliated by Fall Canker-worms.
(Photo taken about June 12th, 1912.)

The Chief Insects of the Orchard.

Our chief orchard insects in the order I intend to discuss them, but not the order of relative importance are: Oyster Shell Scale, San José Scale, Blister Mite, Aphis, Bud Moth, Codling Moth and Plum Curculio. From time to time other insects in limited areas will do more damage for a season or two than any of these mentioned above; for instance, Tent Caterpillars did great havoc to unsprayed orchards this year in Eastern Ontario, and Canker Worms in the neighborhood of Dundas and Stoney Creek, destroyed almost every leaf in June in some neglected orchards. But such outbreaks as these soon pass away and can usually be easily controlled by careful spraying.

Oyster Shell Scale: The figure shows clearly the shape of this scale. In color it closely resembles the bark. The winter is passed in the egg stage beneath the scale there being an average of about 40 eggs under each scale. About June 1st when the blossoms are falling the young scales hatch out into tiny cream colored lice that run around a day or two then settle down and cover themselves with a scale. The females remain here the rest of their lives and lay their eggs under the scale in September. There is only one brood so that one scale on an

average cannot produce more than 40 offspring. Hence, the increase is not very rapid and though some orchards are being severely injured to-day such orchards once freed of this scale cannot become badly infested again for years.

MEANS OF CONTROL: The simplest method is to scrape the rough bark off the trees, prune them well and spray very thoroughly with lime-sulphur, specific gravity reading 1.030 which is equivalent to commercial diluted 1 gal. to 10, *i.e.* 9 gals. of water added to 1 gal. of lime-sulphur. If weaker lime-sulphur (1.008 sp. gr.) is used instead of Bordeaux just after the blossoms fall it will help to destroy the young lice. Usually it requires about two seasons to free an orchard of this pest. The scales though dead will often remain on the trees about two years before falling off and in that way sometimes make the owner think his spraying was ineffectual.

Fig. 2.—Oyster Shell Scale.

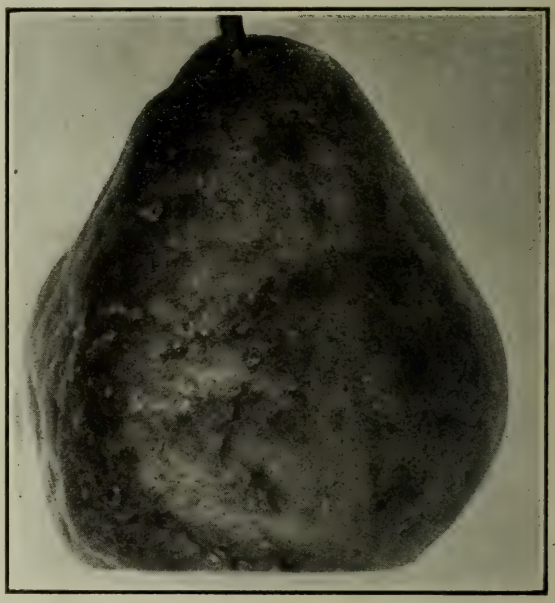

Fig. 3.—San José Scale on pear.

SAN JOSÉ SCALE: Wherever it occurs this is by far the most destructive insect pest that we have. It is spreading every year and already a large portion of the South-western part of the Province is infested. This scale attacks all kinds of fruit trees except sour cherry. It also is found on currants and rosebushes, and on mountain ash, hawthorn and other trees of the Rosaceae family. Once it gets into an orchard it will, sooner or later, unless kept under control by spraying, kill every tree though sometimes it will take many years to do so. Trunk, branches, leaves and fruit are all attacked. On the fruit red discolored areas usually are seen around the scale, caused apparently by some poison that is secreted by the insect. The scale as seen in the figure is very small, not larger in diameter than the head of a pin, almost flat, circular and of a grayish brown appearance, the centre being lighter. The winter stage is black with a distinct nipple in the centre and a little ring or groove around it and is much smaller than the adult scale. Its powers of reproduction are enormous. Each female scale gives birth to about 400 living offspring (no eggs are laid) and as there are

about three generations in a season in Ontario several million scales can be produced from one female before the end of the year. Breeding continues into October.

MEANS OF CONTROL: Careful pruning is always very important but especially so in the case of large trees. These will often have to be headed back to make the spraying easier. The pruning is chiefly to open up the trees so that the spray can be thoroughly applied. Rough bark must also be removed so that this may not protect any insects from the spray. The trees should then be sprayed with lime-sulphur of about 1.032 sp. gr. or stronger, that is commercial diluted about 1 gal. to 9. If any tree is badly infested, it should receive two applications, either one in the fall after the leaves are all or nearly all off and the other in spring before or as the buds are bursting, or both may be given in the spring, the one any time in March or April and the other shortly before the buds burst. To get good results every twig and part of the tree must be thoroughly covered from both sides; because, as we have said, from a single scale more than a million offspring may come in a season.

Fig. 4.—Blister Mite on leaf of apple and pear.

BLISTER MITE: Blister Mites are very tiny wormlike creatures not more than one-hundredth of an inch long, in fact so small that a single one is almost invisible to the naked eye. These mites attack the leaves of apple and pears and cause small blisters or swellings where they feed and lay eggs. The blisters are on the underside of the leaves and are at first whitish, later they turn reddish brown on the apple and almost black on the pear. Trees badly infested often lose many of their leaves, especially in dry seasons, when they can least afford the loss. I have seen leaves dropping from this cause as early as July. Even apart from the dropping of leaves the tree is weakened greatly because the part of the leaf where the blister is cannot perform its function of manufacturing food.

Fig. 5.—Cluster of small, woody, deformed Apples, caused by the feeding of aphids in the twigs and fruit.

Fig. 6.—All the buds except th ose on the extreme left in right stage to destroy aphids by an early contact spray.

Fig. 7.

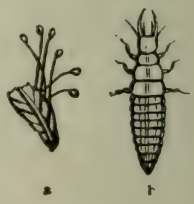

Fig. 8.

(Most food of plants is manufactured in the leaves). Blister Mite is now found in almost every county. It is, like San José Scale, and Oyster-shell Scale distributed originally on nursery stock and then locally by birds or flying insects. (The mites are wingless). There are several broods in a season and the increase is rapid.

MEANS OF CONTROL: This pest is very easily controlled by a single very thorough spraying of the branches and twigs with lime-sulphur in the spring before or as the buds are bursting. It passes the winter under the bud scales and therefore every bud should be thoroughly covered. The strength mentioned for Oyster Shell Scale is plenty strong enough for this purpose. Thorough work will almost free an orchard in one season.

It will be noted that the spraying with strong lime-sulphur for San José Scale will kill also the Oyster Shell Scale and Blister Mite, three birds with one stone.

APHIDS: Aphids are among the most prolific of insects and because of this fact are capable of doing great damage. Fortunately, if we have a fairly dry and warm May and June the enemies of the aphids will usually hold them under such good control that we need not spray for them. If, however, the weather is wet or cold the aphids increase but their foes do not and consequently much damage may be done.

Fig. 9.—Bud Moth and larva.

Our most common aphids are: first the Green Aphis of the apple, of which there are two species, one remaining all season in the tree and the other (the most common one here) migrating from it in July to grass and other closely allied plants; second, the Rosy Apple Aphis, so called from a rosy tint showing through its powdery covering. This aphis also migrates to other plants in July. This was the most destructive apple aphis in Niagara district this year; third, the Black Aphis of the cherry which usually disappears almost entirely about July, but whether it migrates or is merely destroyed by foes like Ladybird beetles and their larvæ is not certain.

Aphids usually feed on the underside of the leaves, and cause these to curl and later turn yellow, and after a time drop off. If there are apples on the branch they are feeding on they cause these to become deformed, stunted and woody in tissue and to hang in clusters. Young trees are often badly weakened and dwarfed by their attack.

MEANS OF CONTROL: Many seasons, as mentioned, the natural enemies of the aphids control them sufficiently, but wherever an orchardist does not like to trust the work to these, there is no better known method than to add Black Leaf 40 to lime-sulphur and spray the trees a day or two before the buds burst. At this time the aphid eggs have all hatched, but there is no place where the young can hide from the spray. We got excellent results from this at the College this year. Instead of this combination, kerosene emulsion or whale oil soap may be used at this date, but the kerosene if made with soap, cannot be combined with lime-sulphur. (Lime-sulphur alone is not a remedy for aphids). After the leaves are opened kerosene emulsion or whale oil soap may be used,

Fig. 10.—Blossoms fallen, calyces open; right stage to spray for coddling moth.

Fig. 11.—Calyces nearly closed; almost too late to spray for codling moth.

Fig. 12.—Calyces closed; too late to spray for codling moth.

but we must not forget that the spray will not kill unless it covers the insects and the more forcibly it is applied the better. An excellent mixture is Black Leaf 40, to every 40 gallon barrel of which about 3 lbs. of common soap or whale oil soap has been added, the soap being first dissolved in boiling water. This is better than Black Leaf 40 alone. Once the leaves are badly curled it is too late to spray with any hope of success. One should remember that most aphids on fruit trees will disappear of their own accord early in July. It will pay well to spray currant bushes with one of these mixtures just before the buds burst.

Bud Moth: This is the little reddish brown caterpillar with a black head that is often found attacking the buds in spring as they are opening, and later feeding upon the leaves, it is almost always concealed in a little nest made from the curled edge of the leaf itself or of partly opened leaves fastened together. The most damage it does is by destroying the ovary or fruit forming part of the buds. Occasionally serious loss is caused. There is only one brood in a season. The winter is passed as a partly grown larva in little dark cases on the branches and twigs.

Means of Control: Thorough spraying with about 3 lbs. of arsenate of lead to 40 gallons of diluted lime-sulphur or Bordeaux mixture just before the apple blossoms burst will gradually bring this insect under control. Some claim that adding poison to the spring applications and applying it just as the buds are bursting helps greatly.

Codling Moth: The life history and habits of this our most common and destructive apple insect have been so fully described in bulletin 187 that I shall pass on at once to control measures.

Means of Control: A single thorough spraying with 3 lbs. of arsenate of lead added to commercial lime-sulphur diluted 1 gal. to 40 (specific gravity 1.008) will, if properly done, satisfactorily control this insect. The spraying must take place immediately after nearly all the bloom has fallen and must be all finished before the calyces have closed. A 10 foot bamboo pole with an aluminum rod inside and a large angle disc nozzle or two on the end is very satisfactory. The nozzles should be held close to the blossoms and directed straight into the open calyx. Every calyx should be thoroughly wet. If there have been many blossoms on the tree this cannot be done without drenching it. If the trees are high, build a tower on the spray wagon to get at the calyces better.

In districts like Niagara where the second brood is usually very destructive a second application about three weeks later will help. Arsenate of lead alone (2 or 3 lbs. to 40 gals. of water) should be used, the lime-sulphur not being added unless specially required for Apple Scab on account of wet weather.

Thoroughness and doing the work at the right time are the secrets to successful control of Codling Moth. Many growers in every district are to-day showing that this pest can be mastered if we really try. Half-way measures are no good.

Plum Curculio: As shown in the figure this is a small beetle less than one-quarter of an inch long, blackish in color, rough-backed and having a long snout. The larva is whitish, usually curled, with a brown head and no legs, thus being easily distinguished from the Codling worm and most other fruit infesting larvae. Apples, plums, pears, peaches, and cherries are all attacked. The simplest indications of attack in the early part of the season is the crescent-shaped scar made by the female around where the egg is laid. If the eggs hatch out, the feeding of

the larvae inside usually causes the apples, pears, plums and peaches to drop while cherries hang on but soon rot. Frequently, even though the eggs fail to hatch or the larva dies soon after hatching, punctured apples and pears are badly deformed as a result of the part around the puncture being retarded in its growth compared with the remaining parts. Late in the season in August and September, apples, especially those of the rough or medium rough skinned varieties, are often badly

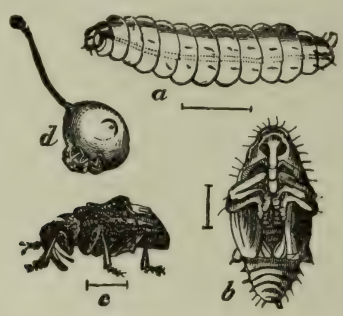

Fig. 13.—Plum Curculio; *a*, larva; *b*, pupa; *c*, adult; *d*, young fruit attacked.

injured by the feeding habits of the new beetles before they seek hiding quarters for winter. These injuries take the form of small brown circular areas about a quarter of an inch in diameter usually with a hole in the centre where the insect's

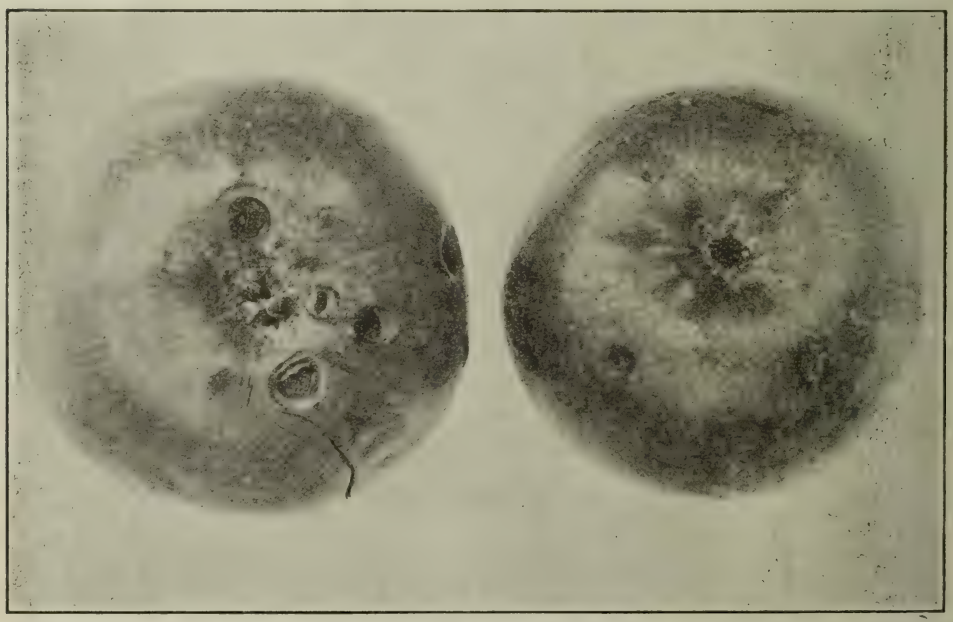

Fig. 14.—Fall work of Plum Curculio on apples.

beak was pushed through to feed beneath the skin all around as far as it could reach. Sometimes the insects enlarge these holes and get bodily into them. Orchards of any kind that are allowed to remain in sod or that have rubbish in or

around them, or that neighbor on woods are regularly worst attacked because these conditions are very favourable to the beetles especially for winter quarters.

MEANS OF CONTROL: The ordinary thorough spraying of apple and pear orchards with 2 or 3 lbs. of arsenate of lead just before and again immediately after the blossoms will do a great deal to control this pest but should be supplemented by the removal of all rubbish and by careful moderately deep cultivation as long as is safe for the district. Plums, cherries, and peaches should be sprayed

Fig. 15.—Black Rot Canker on apple branch.

with the arsenate of lead as soon as the fruit has set and the calyx fallen off. Usually one spraying suffices for peaches as the pubescence holds the poison, but cherries and plums should get at least a second application about 10 or 12 days later. Lime-sulphur or Bordeaux mixture may be combined with the Arsenate of lead for everything but peaches the foliage of which is likely to be burned by these washes.

Diseases of the Orchard.

The chief diseases of apple and pear orchards (we shall have to restrict ourselves to these owing to lack of time) are Black Rot Canker, Apple and Pear Scab and Blight often known as Pear Blight, Twig Blight or Fire Blight, all being the same.

Black Rot Canker: Black Rot Canker is a fungus disease that is very destructive especially along the north shore of Lake Ontario. The more I study this disease the more convinced I am that it follows injuries to the bark especially those caused by winter on trees that are somewhat too tender for the district. Those who will contrast the relative immunity of Snow, McIntosh, and Wolfe River compared with such varieties as Baldwin, Greening, and Ben Davis will be inclined to agree with me. When a dead area forms on any part of a tree and becomes water-soaked, as regularly happens, it forms an ideal place for Black Rot fungus spores to germinate. Once the disease gets an entrance these conditions also favor its growth, and little by little it spreads and attacks the healthy bark until finally the tree is girdled and all above the area dies.

Means of Control: Those who are setting out young orchards should take great care to select only such commercial varieties as are proven to be hardy enough for the district. In orchards that are established already cankers on the trunk and main branches should be cut out with a draw-knife to the healthy bark. (Only the dead bark need be removed) and the part washed with spring strength of lime-sulphur or with 1 lb. bluestone dissolved in about 16 gals. of water, and then painted over either with white lead diluted with linseed oil or with gas tar, the latter being much the cheaper but possibly a little too severe for young trees. Smaller cankers may be scraped with a hoe to remove loose bark, and then covered with tar to keep the moisture out. The exclusion of moisture is very important and often enables the tree to heal the bark all around the canker. Careful spraying of orchards at the regular times ordinarily recommended does much to keep the trees healthy and prevent canker spores from getting a lodgement. In the first application before the buds burst the trunks and main branches should be as carefully sprayed as the rest of the tree.

Apple Scab or Black Spot on the Apple: This is the most common disease found in apple orchards. It attacks both the fruit and the leaves, causing dark colored areas on the latter and the death of the part thus affected. Certain varieties such as Snow and McIntosh are much more subject to the disease than others, some of which like Golden Russet and Blenheim are almost immune. Wet and cold weather in May and early June is very favorable to the disease, whereas fine warm weather prevents its development. Apple Scab not only does damage by marking and sometimes deforming the fruit so that it is unsaleable, but also by attacking the stems while the fruit is very small and so weakening them that it falls prematurely. Furthermore it sometimes injures the leaves to such an extent that these are not able to manufacture a sufficient amount of nourishment to keep the tree vigorous and prepare fruit buds for the next season. Crab apples occasionally are almost defoliated by the scab. The spores of the disease are carried by the wind in spring to the young leaves and careful examination will show infested areas on them by the time the bloom has appeared. This fact is very important when considering control measures. From this date until a week or two after the blossoms have fallen the disease spreads very rapidly and attacks the forming young fruit, and their stems as well as the leaves. After the apples are a little larger

than a marble they are not nearly so liable to attack, probably because of the warmer and drier weather which is unfavorable to scab. Occasionally, as happened this year in some districts, there is a fresh outbreak in August and September, if the weather is wet and cool. Orchards situated along the St. Lawrence seem to be specially subject to the disease.

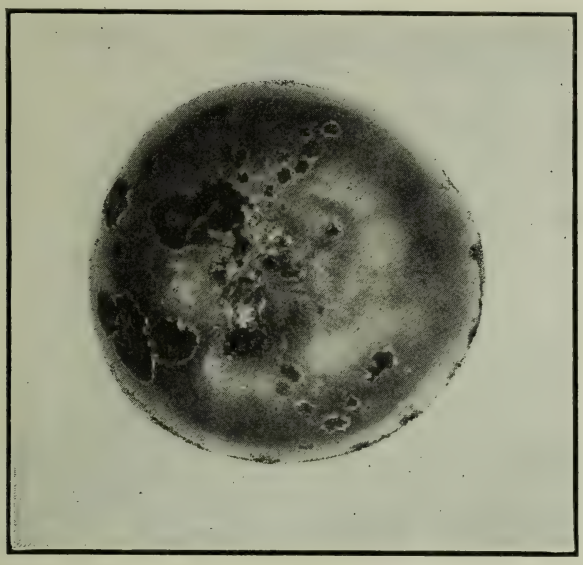

Fig. 16.—Apple Scab on fruit.

MEANS OF CONTROL: In all the main apple districts of the Province, Apple Scab is very easily controlled by a thorough application of either lime-sulphur diluted 1-30 or 40 (specific gravity 1.009 or 1.008) or Bordeaux mixture (4.4.40),

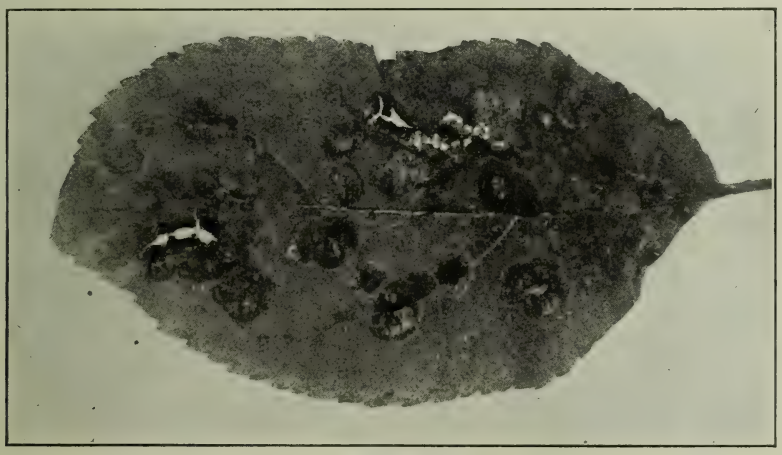

Fig. 17.—Apple Scab on leaf.

just before the blossoms burst and again immediately after the blossoms have fallen. The former corresponds to the application for Bud Moth, Tent-caterpillars and other early biting insects, and the latter to the one for Codling Moth and Plum

Curculio on the apple and pear. In districts like the St. Lawrence valley I should supplement these applications by a later one about two weeks after the Codling Moth Spray, and in seasons like this, by another about the middle of August.

Pear Scab can also be controlled by these same sprayings, but they must be very thorough, especially on Flemish Beauty pears. Lime-sulphur should be diluted somewhat more, say 1 to 45 or 50 instead of 1 to 30 or 40 for pears as the foliage is more susceptible to spray injury.

If we now sum up the spraying of Apple and Pear orchards we shall find that the average orchard only requires three thorough applications under ordinary conditions to control satisfactorily both insect pests and fungus diseases. The first of these should be with lime-sulphur (1.030 specific gravity or stronger) to which Black Leaf 40 may be added if necessary for Aphids and should be applied just before the buds burst, though if Aphids are not considered spraying may be done from one to two weeks earlier. This early application will control as we have seen Oyster Shell and San José Scale and Blister Mite and to some extent will prevent Canker. It may also help somewhat against Apple Scab.

Fig. 18.—Blossoms about to open; ideal stage for first application for apple scab.

The second application should be with 2 or 3 lbs. arsenate of lead to every 40 gallons of lime-sulphur, diluted 1 to 30 or 40 (specific gravity 1.009 or 1.008), or Bordeaux mixture (4.4.40), and should be applied just before the blossoms burst. This application will control Bud Moth, Tent Caterpillars, Canker Worms and many other biting insects, and is very important also in preventing Apple Scab and Leaf-Spot, a disease that I have not thought it necessary to discuss because of the small amount of damage is usually causes.

The third spraying should be with the same mixture as the second, but the more dilute strength of lime-sulphur should be used. This is usually the most important application because upon it depends entirely the control of Codling Moth and to a large extent that of Plum Curculio. It is also the chief application to prevent Apple Scab and Leaf Spot. Too great care cannot be given to this application.

Pear Blight: Pear Blight, Fire Blight, or Twig Blight is such a big subject that I have not time to discuss it further than to say that spraying is of very little value against it, and the proper method to follow is to watch for its first appearance

on young apple and pear trees and cut out diseased branches promptly, never letting the disease get a start on you. In cutting be sure always to choose a place nearly a foot below where the disease appears to have reached because if you do not make sure that you are below it the disease will continue to run on down. Tools should be disinfected in formalin diluted with about four times its own bulk of water for otherwise if you happen to cut through a diseased area the tools will give the disease to the next branches cut. The trees should be examined every week or so and every new case removed. Remember that insects carry the disease, and that the freer the trees are the less chance the insects themselves have to get

Fig. 19.—Pear blight; the arrows show the branches killed by this disease.

contaminated. It is doubtful whether it is practicable to attempt to control the blight in large apple trees. It is well in this case to note what varieties are most subject to it and avoid planting those varieties. (See Bulletin 176.)

Time does not permit of my dealing with the diseases of the plum and cherry. The spray calendar gives the most approved methods of treating these.

THE PRESIDENT: For Mr. Duncan's orchard at Port Hope you would say the ordinary spraying with even the commercial lime and sulphur in the spring will take care of the scale?

MR. CAESAR: I certainly think it will. I am taking it for granted that Mr. Duncan is doing very thorough spraying. By thorough spraying I mean that there is not a single twig or branch that has not been covered. There is a good deal of importance in having the strength of the mixture right. If you have your lime-sulphur diluted one to twelve or so it is pretty weak. These are seasons probably in which that will do the work, but the average season it does not seem to be strong enough. I am speaking of commercial lime-sulphur. If you use home-made you will have to go according to the formula given. There is a table given setting out how much to dilute and how to test the strength of any mixture you make. With the commercial if you dilute it about one gallon to seven gallons of water, that makes one to eight, as we call it, or one to seven as the commercial men would call it. You can put it stronger if you like, but that is strong enough to do the work. Then there are always conditions to be considered. If it rains shortly after you have sprayed you are likely to have poor results. If you spray when it is freezing you are not likely to have good results.

Q.—How strong would you have to make lime-sulphur to make it injurious to your tree?

MR. CAESAR: If you put on your lime-sulphur when your buds are not out too far, you can scarcely injure your trees if you use one gallon to five of water. You should never test in the tank. You should always work it out by rule. You cannot make an accurate test in the tank, or very seldom, because some of the previous mixture may be in there, and the sediment when it is mixed up always interferes with the test. When you are testing anything test the clear liquid before you dilute it and then work it out by rule. That would probably give you about 1.050.

Q.—If you drain your tank before you put your mixture in and then test, it may be alright.

MR. CAESAR: I never test a tank after I put in the lime-sulphur. I always work it out by rule, because I know that is correct. If you are uncertain about your lime-sulphur you can test it right out yourself by taking a small quantity and diluting it and then testing that in glass vessels. You put your hydrometer when the liquid is cooled right down to normal, and when there is no sediment, then see how far it goes down. If it reads 1.210 that is fairly weak. Now, your rule is merely this: If you want to get a strong mixture of 1.040 you divide 40 into the last three numbers, the last two figures into the last three figures. If it is 1.210 divide the 210 by 40. That will give you 5¼, and that means one gallon to make 5¼ gallons of that strength. If you want to make it 1.030 all you have to do is divide 210 by 30. But that is the time to work out your method of dilution.

Q.—Supposing you were spraying when it is pretty well out? Supposing it is a dull day and you spray and it is sometime before it dries, will it burn?

MR. CAESAR: If the spray remains on the leaves a long time without drying they are much more likely to be burned than if it dries rapidly. I think there is sufficient evidence to justify me in saying that.

Q.—Is the scale more liable to be killed?

MR. CAESAR: Yes, I should say they are much more liable to be killed.

Q.—A bright warm day is the safest time to spray?

MR. CAESAR: Yes.

Q.—Have you noticed any injury to the fruit buds by spraying?

MR. CAESAR: I have noticed a little. When the buds were on the point of

bursting I have occasionally seen on crab apples a few buds injured, and an occasional one on apple trees.

Q.—I mean from fall spraying?

MR. CAESAR: I have never done any fall spraying. I know it is practised a good deal. The New York men claim sometimes it injures the fruit buds if it is put on rather early.

Q.—Frequently it happens that you run across an orchard that you want to help during the season, and it is too late for that first spraying with strong lime and sulphur. Have you had any experience with using any of the coal oil emulsions?

MR. CAESAR: For what?

Q.—For either the Oyster Shell or the San José Scale?

MR. CAESAR: The trouble with the San José Scale, to kill the adult scale you have to make it so strong you kill the foliage. To kill the young scale you have to apply it time after time, because the first scale that is hatched is maybe forty days before the last one.

If you miss the first spray I would put on a good strong spray as soon as ever you can. I would not be at all afraid to put lime-sulphur on a badly infested orchard at the strength of one to fifteen, because it is far better to do a little injury than to leave the scale, or even one to twelve for a little while at first.

Q.—What about the Oyster Shell Bark Louse?

MR. CAESAR: That would be better controlled by waiting until it hatches out, and then give it a couple of applications either of lime-sulphur or an application of kerosene emulsion, just after it is hatched out.

Q.—We had splendid results last spring in fine warm dry weather when the buds were out an inch and a half long. It did not hurt them at all.

MR. CAESAR: I know. Mr. Biggar could tell you of an orchard he sprayed with full strength lime-sulphur when it was out in foliage, but you can't do it all the time. You can do it more easily in the early part of the season than the latter part. The longer an apple leaf has been out and becomes fully developed the weaker it tends to get, and the more opportunity there is for the spray to penetrate. While the epidermis is closer and the leaf is young there is less liability to injury.

MR. BUNTING: It is well to do it as early as possible, but if you cannot do it continue it later on in the season.

MR. CAESAR: If you cannot get at it before the buds burst go ahead and give it to it afterwards. Give it not quite so strong, but fairly strong, because the San José scale cannot be played with and you have got to spray very thoroughly.

Q.—Would you advise spraying while the trees are wet?

MR. CAESAR: No, if you spray a tree when it is wet it dilutes the spray a great deal and it does not do as effective work as it otherwise would.

Q.—Has arsenate of lead any effect on the aphid?

MR. CAESAR: Not very appreciable. Lime-sulphur will not kill them. They have taken them and dipped them in lime-sulphur. Occasionally I have destroyed quite a number, but you cannot destroy half of them. Many of our American friends and British Columbia friends say you can destroy the eggs with lime-sulphur, but I cannot.

Q.—That Black Leaf 40 is a proprietary thing?

MR. CAESAR: Yes. I am hoping we can get a tobacco of our own.

Q.—We are looking up in Essex to you to get it this year for us.

MR. CAESAR: I will do the best I can. We will get the chemists interested in it if we can. Now, supposing you do not spray before the buds burst, and yet you see the aphis coming on do not wait, saying, I think I will do it in another week, but go right at it at once. If you find they are so bad that you think they are going to do a lot of damage, then probably the handiest thing you have will be the kerosene emulsion, and give them a thorough spraying as soon as the leaves have opened or as soon as you find them threatening to be real bad. When the leaves have once got curled you cannot do anything with them. Then another thing you must remember is that most aphis on apple trees and on cherry trees will disappear in the first warm weather. This year they had all gone by the 7th July. It is true they come back in the nursery stock later on, but most of them go. If it is coming on towards July you may hope for them to disappear of their own accord.

Q.—But not without having the damage done?

MR. CAESAR: No, the damage will be done.

Q.—Would similar remarks apply to the black aphis on cherry trees?

MR. CAESAR: It is very difficult to say whether they go of their own accord or whether the lady bird beetles and such like in great numbers control them. I could not satisfy myself this year, but I know they disappeared early in July.

Q.—How do you account for the green aphis in the spring, and then along comes the rosy aphis? Where were they in the spring?

MR. CAESAR: The rosy aphis were there, but not very many. The speed of reproduction borders on the miraculous. If I were to tell you how rapidly they multiply you would say I was the worst fabricator that was ever found in this hall, so I will not attempt it.

Q.—Do you use molasses or glucose for the curculio?

MR. CAESAR: It doesn't seem to have any value as far as we could tell. This year there were quite a number of tests made and it did not seem to have any additional value. Quite a number reported they could not see any difference.

For apple scab you have to spray thoroughly. It would have been desirable in most districts this year on account of the wet season to have sprayed again about the middle of August. In fact I recommended any person who asked me about it to give an application about that time. In the St. Lawrence River Valley I would recommend four applications in the spring, the fourth one about two weeks after the spraying for the codling moth. Then I would recommend another application in the fall of the year, around the 10th of August, because it is a very difficult problem to control it. Once it gets into the leaf or into the fruit your lime-sulphur will not destroy it.

Q.—Will it prevent it from growing any larger?

MR. CAESAR: No, once it enters through the epidermis you cannot prevent it. You can prevent it from going to other parts. It is when the blossoms open that you get the scab on the leaves, and if you get them before they have opened you cover over your leaves with something in which the spores cannot grow.

Q.—Lime-sulphur or Bordeaux mixture?

MR. CAESAR: I do not think there is any difference.

Q.—You spoke about the canker, and the trees not being hardy enough causing it. In the past season I have had some experience with trees in a place where they are not inclined to be hardy, on Manitoulin Island and I have not yet seen any of these black rot cankers. In what way does that spread? For instance, they are bringing nursery stock in, and why has it not yet appeared?

MR. CAESAR: It does not spread as a rule from nursery stock. It may spread from apples brought in that are affected. When an apple begins to decay you get what they call a hard rot. The apple first begins to look brown, and that is really the black rot disease in the apple. That apple will turn black and get little pimples all over it. Fruit brought in that is infested and thrown out would be a means of spreading it. In the nursery stock if there are dead twigs or dead parts of the trunk it may get a start in that dead wood, but not very likely. I am rather surprised you are not finding it up there.

Q.—Has the planting of fruit trees along a windbreak in an orchard anything to do with that ink spot?

MR. CAESAR: Yes, by the prevention of the circulation of air and light.

Q.—I know an orchard in our community and if there is any ink spot in the country that orchard gets it, and it is worse along by some spruce trees.

MR. CAESAR: Yes, those spruce trees are liable to favour apple scabs. Anything that prevents the circulation of light and air is favorable to any of these diseases.

Q.—You would not advocate doing away with them altogether?

MR. CAESAR: I do not know that I would express an opinion on that. Unless you have got an orchard in a very exposed place I would make my first row of apple trees serve as my wind break. If I thought that wasn't enough I would put another row. I do not like wind breaks myself except in very exposed places or in very cold climates.

Q.—You would not recommend a wind break, but if you had one?

MR. CAESAR: If I had one I would try to counteract it by spraying, because we all love a beautiful wind break. With good spraying you can overcome it in almost every district I think.

THE PRESIDENT: Do you know anything about dust sprays?

MR. CAESAR: They were tried out a good deal a few years ago and they have dropped out almost entirely as being inferior to the ordinary wet spraying.

Q.—Take orchards that are headed back or cut back near the limb so that a good current of air can get through, do you find many of them much affected with ink spots even this year?

MR. CAESAR: I cannot answer that because I have not been around enough to see, but that would be a condition favourable to keeping apples free from ink spots.

Q.—What is the best means of preventing pear blight?

MR. CAESAR: That is a big question. There is only one thing to do with pear blight, and that is act quickly and keep on acting. Pear blight starts in the spring of the year when the blossoms are open, and that is the time it is carried, especially to apples. On large apple trees I doubt if it is at all practicable to attempt to control it. You should try to control it on young apple trees, because it may spoil your young apple trees altogether, say from one year to ten years of age. With pear trees you can control it fairly well in most seasons. Now, pear blight starts with the blossoming time. You can see that easily if you go to an apple orchard. You wonder what made that branch die, and you go to another tree right by it and it is not badly affected at all. If you look at it you will find it is the twigs with the blossoms on that are dead with blight. It is something and it must be the blight. It is carried then at the time of the blossom, and you will not see the effect of it for nearly two weeks afterwards, because it develops very slowly at first. Then it will spread throughout your orchard from

diseased parts to healthy parts by means of insects. Now, if you want to control it you want to have as few twigs as possible for the insects to feed on and get contaminated therefrom and carry it off to the others. For that reason one should watch in the early part of the season and cut out every twig that is affected just as soon as you see it is affected, because it will run right down those twigs, especially on pears and on tender young apple trees and crab apples. So cut those out as soon as you see they are affected, and always cut quite a little distance down below, and disinfect your knife or your pruning callipers by dipping them into a solution of one part formalin and four or five parts water. That is the cheapest substance I know of for disinfection. If you cut them out at the early part you are giving the insects a poorer chance to get infested than if you leave them quite awhile, and you will find many other twigs that you did not expect were affected, and you will be discouraged. The whole thing comes down to this: Cut out the pear blight as soon as ever you see it in your pears and young apple trees, and cut well below, and disinfect your tools, because if you cut a diseased part and then cut a healthy part you are almost sure to give it the disease. You can put ten thousand of those things on the head of a pin. If you go through your orchard from time to time, every week or so, they would get fewer and fewer each week.

Q.—Why not cut it out of the big apple trees?

Mr. Caesar: You cannot get the time.

Q.—Have you introduced the bacteria into healthy limbs?

Mr. Caesar: Yes, frequently. It has been done hundreds of times. You can take your knife out and do it any time you want to.

Q.—Didn't you say at one time you could use coal oil to disinfect it?

Mr. Caesar: Coal oil would disinfect but formalin is nicer. It is not so hard on the tissues.

Q.—How can you tell whether the aphids are going to be bad?

Mr. Caesar: You cannot tell, because 99 per cent. of them in the ordinary season will be dead before next spring. You cannot tell whether it will be bad next year or not. Out in British Columbia it is the greatest pest they have got.

Mr. Caesar: There is one thing I would like to mention. I am hopeful that we will have a new poison cheaper and better than arsenate of lead in a couple of years. I tested one out this year, an arsenite of zinc, a much nicer poison to work with and saves a great deal of time, and besides is considerably cheaper. It stands up better in the water, and it does not take near so much agitation, and sticks just as well as the arsenate of lead, and no damage whatever to the foliage. However, one year's experience is not a sufficient test, but it gave quite as good results as the arsenate of lead, and we thought a little better. It was tested on a very large scale at Hamilton, by Mr. Beck, and Mr. J. E. Smith tested it a little, but not sufficiently to amount to very much. We intend to test it again next year. I would not advise you to go into it until we try it another year. If it is going to work out as we think it is it will be a good thing and I think one of our chemical companies will take it up next year and manufacture it, and if it is sold as cheaply as it is sold in California there will be a considerable saving in money and a considerable saving in time.

Q.—What was the cause of our apple trees dying last year?

Mr. Caesar: The severity of the winter. It was a case of the trees that bore heavily not being hardy enough to stand it.

Q.—Could you make the lime-sulphur very weak and get the same results with the rot?

MR. CAESAR: Not very well. If you make it one to fifty you make it too weak for the rot.

Q.—We find a great deal of leaf spot from that on our trees?

MR. CAESAR: There is one point I would like to mention. A pretty good test was made by Mr. E. Henry and his son. I asked him to make some tests on the effectiveness of lime-sulphur on plum trees for rot. He tested it this year and it was a pretty good year for rot, favorable for it. He told me in his opinion the lime-sulphur gave better results this year than the Bordeaux mixture. Both of them gave clean plums, but the foliage was decidedly better where the lime-sulphur was put on. I attribute this to the fact that the red spider was exceptionally bad this year in the Niagara district, and in some orchards the leaves looked the color of dust, that hazy brown color. The lime-sulphur would control those by having it about one to forty for the ordinary season. On the Japanese plums it would be better to use the Bordeaux mixture.

Q.—About what proportion of arsenate of soda do you use?

MR. CAESAR: That is better not used at all on fruit trees. Arsenate of soda cannot be used with lime-sulphur at all, but it may be used with the Bordeaux mixture. The arsenate of soda will burn everything if put on by itself. I have burned trees and taken every leaf off.

Q.—I did not last year by using plenty of lime.

MR. CAESAR: I know man after man who has used it and had no burning, but again there are cases of most severe burning, and therefore we cannot recommend it.

TRANSPORTATION PROBLEMS.

MR. G. E. MCINTOSH, TRANSPORT AGENT OF THE ASSOCIATION, FOREST, ONT.

In introducing the subject of transportation as applied to the great industries of fruit and vegetable growing in the Province of Ontario, I am conscious of the fact, and I believe the growers are also conscious of the fact, that transportation with all its problems, is one of, if not the most important of all constituents, which go to make either of these industries a success for the producer.

In the case of fruit you may prune, spray, cultivate and practice every precaution in the picking, packing and loading, but just as soon as it passes into the care of a carrying company, be it railroad or steamboat, it rests with them just in what condition the fruit will appear on the market. Transportation is therefore, probably the most important factor in the "make or break" of the great fruit industry of Ontario.

It was with a realization of this that the joint Transportation Committee of the Ontario Fruit Growers' and the Ontario Apple Shippers' Associations, have begun an aggressive campaign along the line of securing better facilities and improved conditions in many ways for the proper handling of fruit from the Railway and Steamboat Companies. The Committee having this work in charge is composed of men of wide experience; men, whom I am satisfied will give this great problem the close study it demands, and eventually force improvements.

To the many whom I have interviewed, I wish here to express my appreciation for the kindly manner in which I was received, the interest manifested in my work, and for their willingness in giving any information within their power to

facilitate the gathering of all possible data. The question of transportation is indeed a very great one—may I say a life study, and I realize that you gentlemen having years of experience in dealing with the carrying companies, know very much more about existing privileges than I could hope to learn in the short time I have devoted to this work. I will endeavor, however, to outline as briefly as possible some of the conditions I have observed, and to call your attention to a few of the outstanding features which have impressed me most strongly, also to briefly place before you a synopsis of a portion of the facts gathered supporting certain requests for improved conditions submitted to representatives of the different railways.

That just grievances against the railways exist is a certainty, and the efforts of the Transportation Committee to remedy some of these have been useless from the fact that the weakest point of the average shipper to-day, is not keeping specific data of all shipments. The Railway Companies, however, will very soon find this condition of affairs will be changed, because the shippers are now seeing the importance of such, and we hope from forms sent out to be able to meet the railways with a compiled report of the moving of the entire fruit crop of the Province, condition of cars, delays, etc.

Delays in Transit: The Railway Companies have been asked to provide a minimum rate of transit for apples by freight in carloads, of ten miles an hour. Certainly not an unreasonable request, yet from figures I have compiled and from records received from shippers, it appears the average rate of transit on western shipments is considerably below ten miles per hour. One shipment to Moose Jaw, 1,633 miles, did not average three miles. Another to Calagary, 2,071 miles, a trifle better than four miles per hour. Others to Saskatoon, 1,714 miles, just three and one-half miles per hour. Another to Regina, 1,591 miles, not quite six miles per hour. One to Winnipeg, 1,234 miles, three and one-third miles per hour, while the average on fourteen carloads from different points to Winnipeg, was scarcely seven miles per hour. One shipper alone reported to me on eleven carloads to Winnipeg as follows:

1 car	7 days
2 cars	8 days
1 car	9 days
1 car	10 days
1 car	13 days
1 car	14 days
3 cars	15 days
1 car	16 days

The losses sustained by these shippers averaged from $125 to $330.

While this is a most serious state of affairs, it is going to entail no end of trouble to have it remedied, because of the fact that the Railway Board has repeatedly held that where application has been made to them for redress or losses sustained by delay in transit, they have no power to award damages for the delay; that the remedy of the party or parties aggrieved was to be found by action in one of the regular courts. It follows then that the fruit growers can look for no improvement in this respect until by a submission of facts relative to the moving of our whole crop or the greater portion of it at least, we can prove to the Board the necessity of an investigation for the purpose of devising a remedy for a defective system.

Delays in Getting Cars: A request has been made that when Railway companies fail to furnish suitable equipment for the transportation of fruit within

three days, after an order is given, they become responsible for direct or indirect loss caused thereby. Many growers and shippers have suffered considerable loss in this respect. Last season the shortage of cars was experienced by nearly every shipper, but it is an outstanding fact that the greatest difficulty in getting service was at non-competitive points. Shippers, whose names I will not mention here, waited two weeks for refrigerator cars, and eventually were forced to use box cars. Under such conditions, with the shipper liable for demurrage after holding a car a certain length of time, it seems only fair that when the railway companies cause loss to the shipper by not supplying cars in a reasonable period, they also should become liable.

Reports of Cars in Transit: The difficulty in this respect seemed to centre in not being able to get reports from local agents, the shipper having to apply as a rule to divisional agents, and at some expense. The railways have recently consented to give this information daily, and without charge, by application to the local agent.

Completing Part Carloads in Transit: This is a privilege (the importance of which is well known to every fruit shipper) that is now standing before the Railway Commission. We ask simply to be put on a fair competitive basis with the fruit shippers of the Okanagan district of British Columbia, who enjoy an inward freight minimum of 10 cts. per 100 lbs., or a similar privilege to that granted shippers of horses, cattle, hogs, sheep, live poultry, grain, canned goods, lumber and poles, who can ship part carloads at carload rate and weight from point of shipment to destination, and stop for completion of load for $3. The fruit industry the present season has suffered greatly, especially in the newer districts, because of not being able to ship in carloads, and had to market at evaporator or canning factory prices. Under present conditions there is no special provision whatever for completing carloads of fruit in transit, although in some districts 75 per cent. of the entire crop has to be assembled at a central point by teaming or by paying an almost prohibitory local rate, and then compete in the western market with B.C. growers, having privileges we do not get.

We are conscious of the fact that railway companies wish to encourage shipping in all commodities, and are showing favor or preference to those we have mentioned as enjoying this stop-over privilege, given at a time they tell us when they were infant industries, to encourage carload lots. Will it not have the same effect with fruit shipments? Most certainly. The tonnage of fruit is to-day considerably less than grain, live stock or lumber.

In 1907 the railways carried 5,776,731 tons of grain, and in 1911, they carried over 7,000,000 tons; live stock over a million tons, lumber over seven million tons, and fruit and vegetables 957,237 tons. I submit these figures to show that if the granting of this privilege in the case of live stock, grain, etc., has been done to encourage shipping of such, and to the canning factories as an encouragement to an infant industry, then the fruit shippers, handling a highly perishable article, and paying a rate much higher than on canned goods, double that of live stock, two and a half times that paid for lumber, three times the rate on grain and four times greater than on poles, should have equal advantages. We base our claim on the absolute necessity of some such privilege to enable the Ontario growers to get the best markets at the proper time, and finally we base it on Section 317 of the Canadian Railway Act, sub-section 3, which reads, "No Company shall make or give any undue or unreasonable preference or advantage to, or in favor of any particular person or company, or any particular description of traffic, in any respect whatever."

Shortage of properly equipped refrigerator cars—from statistics gathered, there is no doubt that the railway companies are not keeping pace in the supply of rolling stock, with the development of the country, and that the existing refrigerator car service is unsatisfactory. There are several instances, notwithstanding all the care taken by the producer of fruit to select and pack his fruit in a careful manner; that when it is handed over to the railway companies it is done at a very great risk. It is not an unusual occurrence to order cars with heaters, and they arrive without heaters or heaters of no use, out of repair, cars open, and without slatted bottoms, or probably have to accept box cars, line and slat them. Shippers, however, are compelled to make all such repairs to safeguard their shipment, without any recompense from the railways. The expense to some being as high as $200 annually.

The late Chairman of the Railway Commission, Judge Mabee, when hearing the complaint of the grain shippers clearly set forth the fact that a shipper should not have to fit or repair a car for his goods, but that the railway company should supply a car suitable for the carrying of his shipments, and the Board accordingly ordered that the companies pay shippers who furnish grain doors for box cars from 50 cents to $3.00; live stock shippers who supply planks and spikes for doors $1.25, and shippers who supply doors in certain cars for the shipment of coal, from 50 cents to $3.00.

We all appreciate the difficulties the railway companies are in, in the way of keeping cars in proper condition; but after all, this is one of the burdens that the carrier has to bear, and it should not militate against the shipper.

The statistical facts reveal a state of affairs in regard to refrigerator car service that is surprising. Accurately comparable data supplied by the Minister of Railways and Canals, from sworn returns furnished by the railway companies shows clearly that the companies are not supplying a refrigerator service equal to the development of the fruit industry or the demand of shippers of perishable freight. It is a surprising fact that one of our principal railway companies has to-day 10 refrigerator cars less than they had four years ago, while the tonnage of fruit and vegetables carried by the company has steadily increased. The total refrigerator car equipment of the three principal carrying companies operating in Ontario, the G.T.R., C.P.R., and C.N.R. in 1908, was 2,040, and on June 30th, 1911, it was 2,409, a very small increase compared with the increase of fruit and vegetable shipments on these lines from 429,930 tons in 1908, to 607,478 tons in 1911.

Storage: Accommodation for the storage of fruit, particularly peaches, plums, cherries, etc., awaiting shipment is another important matter, and one which is quite inadequate, except in the older fruit districts. It is apparent as the Act now stands, orders for improved facilities for handling express traffic can only be made against the railway company. The Railway Board has no jurisdiction to compel express companies to use a particular class or kind of car, or to provide shelters at points of shipments or destination. This apparently is a complaint which should be lodged against the railway company, and is a matter which should be dealt with at once, at some shipping points.

The late Chairman of the Board said: "If express companies do not provide for car service, shelters and the like, with the railway companies over whose lines they operate, and remove all proper cause of complaint, then it will be the duty of the Board to deal directly with the railway companies as to these matters, and complaints from the public must be made against them."

CLAIMS: A great many shippers throughout the Province report considerable difficulty in getting reasonably prompt settlement of claims for damages caused by negligence on the part of the carrying company; the costly manner in which disputed claims have to be settled by recourse through the courts; and the "wearing out" procedure of the companies in delaying these settlements, is costing the fruit shippers thousands of dollars. Many prefer to drop their claims rather than follow the only course now open to them for collection. Losses by pilfering are also many, but where this loss comes back to the shipper, it might be well to point out the fact that he alone is responsible. He has the right to demand a clear bill of lading for his goods, (without notation "Shippers' Count—more or less, etc.,") for the number of packages loaded, provided that before commencing to load he notified the agent or his representative, that a clear receipt will be required. Strange to say, however, of the total number of shippers called upon the past season, only 18 per cent. knew they had this privilege.

Again the Commission has ruled that they have no power to issue an order in reference to rough handling and pilfering, but is a matter that must be dealt with by the shipper or receiver under civil law in an action for damages.

The Railway Commission is a Governmental agency of real authority and a Federal tribunal of far reaching influence and power—A "friend at court" of the public, but after all instances as here outlined, establish the fact that having no jurisdiction over such subjects as settlement of damages, jolting, rough coupling, delays and pilfering, there is a need of extending their power, especially in the matter of claims; power to adjudicate on claims standing over say six months, and to settle damages caused by unreasonable delays, such as I have pointed out in our western shipments. The Board, however, affords every opportunity for the shipper to prosecute his claims however small, that may come under their jurisdiction, and provides a tribunal for the determination of transportation questions without costs to the parties. The individual shipper has by course of law been transformed into the general public. The carrier has by like process of law been transformed into a public agency; to which we may add that in the great game of railroading, the Railway Commission has by course of law been transformed into the umpire. They give a fair deal so far as within their power, but legislation should extend their jurisdiction.

MARKETING: There are two principal difficulties that must be overcome, the excessive express and freight charges, especially west of Winnipeg, and the present system of distribution. There are some markets that are now being supplied by express which can be reached just as quickly by freight, but here again the delays in placing cars makes the unloading time too uncertain to take the chance.

In regard to distribution, more particularly in districts where growers have not organized; fruit is sent on commission to all cities in Ontario and some western points. Market reports are circulated of some markets that are higher than others and these places will receive large shipments, with the result that they are flooded and prices lowered, perhaps never to recover for the season. This is the results of growers shipping independently, not knowing what each other are doing, yet all shipping to the same market, and while this market is being overstocked, others are not getting their requirements.

I would strongly urge the advisability of closing following conditions at the Canadian Soo, for at present it looks as though that market, which is a rapidly growing one, will be one of those lost to the Ontario grower from American competition, if better freight service is not restored, and better rates given. The

present season, the Northern Navigation Company would accept freight for that port only one day a week. This had the effect of forcing the dealers to buy American products, and practically shut the Western Ontario fruit counties out of that market. I was surprised while there in August to learn that large dealers had placed apple orders with growers at Lyons, New York, and landed early varieties at the Soo for 42 cents a barrel freight, as against 60 cents freight for Ontario apples, and that they could bring them from Illinois and Ohio for 22 cents per cwt. The day I was there, 1,000 bushels of Elberta peaches were bought at the American Soo for $1.25 per bushel, and were supplying the market in the Ontario Soo. The American fruit and vegetable dealers were not slow in taking advantage of the existing freight conditions in their favor this season, as a Minneapolis firm were then erecting a large warehouse at Sault Ste. Marie, Ontario, for the handling of American fruits and vegetables for Canadian consumption. This condition of affairs was a serious matter for the growers of Lambton and Essex Counties, particularly the former, where the industry is only in its infancy and carloads at any one point is an impossibility. They depended on the Soo market, and by shipping through a Sarnia dealer gave the Soo buyers the benefit of the carload lake and rail rates at 20 cents per cwt. on vegetables, 38 cents on fruit and 25 cents on apples, and the quick despatch of 20 hours. It was my privilege to place these facts before the Board of Trade at Sault Ste. Marie, who later took it up with the officials of the steamboat company, with the result that they have looked into the matter and report that they purpose next season to have a new dock with sufficient facilities to resume the freight service.

I regret that the short time at my disposal will not permit me to deal with some important matters relative to marketing at Port Arthur and Fort William, suffice it to say that there is very great need of inspection at point of shipment for all fruits going into these markets.

Freight and Express Rates: The rates east of Winnipeg have appeared to be fairly satisfactory, but at these points, where the Ontario grower is brought in close competition with the American grower, the question of rates is a very important one. Mr. Cannoss, of the Fitzsimmons Fruit Company, Fort William, said: "The freight rates on American roads are so much lower that I was able to buy June tomatoes from Texas, pay the freight and duty and sell them at $1 and $1.20 per crate of 20 lbs.

The following few comparisons bear out Mr. Connoss' contention in a somewhat surprising manner:

Minneapolis to Sault Ste. Marie, Mich., 494 miles, carload rate, fruit per 100 lbs.	30 cents
Forest to Sault Ste. Marie, Ont., 325 miles, carload rate, fruit, 169 miles less haul	54 cents
Chicago to Sault Ste. Marie, Mich., 673 miles, carload rate, onions, per cwt.	22 cents
Forest to Sault Ste. Marie, Ont., 325 miles, carload rate, vegetables, per cwt., 348 miles less	26 cents
Grand Rapids to Sault Ste. Marie, Mich., 415 miles, carload rate, vegetables, per cwt.	25 cents
Forest to Sault Ste. Marie, Ont., 325 miles, carload rate, vegetables, per cwt., 90 miles less	26 cents

The above rates from points named to Sault Ste. Marie, Port Arthur and Fort William, though but a few instances, show that the rates levied upon fruit and vegetables even east of Winnipeg, are sufficiently high to drive the Ontario

product out of some of the best markets and create a demand for goods imported from our neighbors to the south. What is being done at these points is also extended to points west of Winnipeg, where Ontario fruit burdened with an excessive freight rate, is brought in competition with British Columbia fruits, especially in Alberta and Western Saskatchewan, and also with Nova Scotia apples, and some from Washington and Oregon. British Columbia fruit shippers recently appealed to the C.P.R. for a reduction of rates to this market, resulting in the following reduction on apples:

Kamloops District to Calgary	from 70 cents to 62 cents
Okanagan District to Calgary	from 70 cents to 60 cents
Spence's Bridge to Calgary	from 80 cents to 68 cents
Okanagan points to Medicine Hat	from 75 cents to 71 cents
Spence's Bridge to Medicine Hat	from 85 cents to 79 cents

This reduction means a saving of $24 a car, from Okanagan to Calgary.

A further reduction was also granted from Okanagan to the Coast, on apples and fresh fruits, the former from 45c. to 40c. per 100 lbs., and the latter from 53c. to 48c.

C.P.R. and G.T.R. tariffs becoming effective April, 1912, show some reductions on rates for apple shipments from Ontario to Western points, but they are not yet on a fair basis; the most noticeable reduction is that of Edmonton, 2,079 miles reduced from $1.15 to $1.04. Comparing even this with the $1.03 from Berwick, Nova Scotia, to Regina, 2,787 miles, a haul of nearly 700 miles farther and at a less rate; it does look as though there is yet room for some further reduction.

Another instance: A carload of apples can be shipped from St. Catharines to Winnipeg, 1,234 miles, for $127.20, but to haul it 480 miles farther to Saskatoon, the additional charge is $91.20.

The above comparison might also be applied to express rates.

A carload of fresh fruit shipped by express from the Niagara district to Winnipeg would cost on 20,000 lb. minimum, $530.00, but to haul it the 480 miles farther on to Saskatoon, the charge would be $880,00 or $350.00 extra for the additional 480 miles.

Another glaring example of the unjust manner in which express rates are levied is between Forest and Winnipeg. In the case of Sarnia they have an express rate of $2.90, whereas Forest shippers, 23 miles less haul, are assessed $4.40 per 100 lbs. to the same point.

Calgary to Winnipeg: If these rates both freight and express were made more reasonable for the Ontario fruit and vegetable grower it would undoubtedly stimulate western trade.

I have endeavored to outline briefly some of the fruitmen's difficulties in connection with transportation, and some of the recommendations of the Transportation Committee for improvement of such. There are many other matters suggestive of improved conditions that I am not permitted to deal with in this paper, but there is one most important suggestion I wish to drop before closing. It is in regard to the handling of export shipments at Montreal. There is a very great need of either making our fruit inspectors there also cargo inspectors, or have a special inspector for the purpose of seeing that your apples are given at least reasonably careful handling.

You growers are by legislation, and subject to a fine, compelled to take every conceivable precaution and care until your apples are on the cars. Why, then,

in common justice should our Government not make these men handling them at the export points responsible to a Government official. Can you imagine the effect of piling boxed apples on the bilge? If you can, you can perhaps have some idea of my feelings when I saw, two weeks ago, nearly two carloads so piled in one of the sheds at Montreal. I venture to say, and with all due respect to the steamboat companies and to the railway companies, too, because fault lies with both, that some of the handling I witnessed would render the apples practically unsaleable. I am satisfied that fruit inspectors stationed there are doing their very best under the circumstances, but conditions there must change. This is a matter that your Transportation Committee will probably deal with later on.

In conclusion let me say, it is the little details that every shipper should watch in order to secure minimum rates and maximum privileges for transporting his goods. One of the most common errors is to neglect the shipping end of a business, while probably nowhere could a few hours be spent more profitably than in studying the secrets of the classification and the tariff sheets.

I trust the work begun by your Transportation Committee will go on; that they may have as the goal of their ambition in this work the unravelling of all transportation problems, and a persistent attack for the rights of the fruit shippers of Ontario. This will not be accomplished at one time, but continuous efforts must bring results. The assistance, however, of every grower and shipper must be enrolled, and when that is accomplished the railway companies and the steamboat companies will have a power behind that will force a reasonable solution to present day transportation problems.

May I conclude this paper by urging you to interest yourselves in this great work. In unity there is strength.

Mr. Geo. Robertson, St. Catharines, stated the case of his shipping by Canadian Express 40 baskets of cherries consigned to John Caldwell, Montreal; that they were delivered late in the afternoon and sold for about two-thirds of what they should have sold for in the morning.

I put in a claim, and I have the reply in my pocket from the Canadian Express Company, asking me to withdraw the claim as the Grand Trunk train had been delayed some hours and minutes at Newtonville, and it was out of their control. I intend to reply to them and tell them I will keep their reply as a souvenir, and hope it will aid in rectifying some transportation matters in future. The stuff was sacrificed at two-thirds of its value and I put in a claim for the difference. (Reads letter).

Mr. McIntosh: The Railway Commission should have power to deal with such matters. They claim that it is out of their jurisdiction entirely. That is one of the points I fell like pressing before this meeting, that there should be legislation to extend the powers of the Railway Board to this extent, to adjudicate on all claims standing over six months. I know of instances of shippers who have waited five years, and I have no doubt this gentleman will have to wait quite a while for this claim.

Mr. Armstrong: I think Mr. McIntosh deserves a very hearty vote of thanks from this Association for that report. As an old member of this Association I never remember listening to such an elaborate report as I have just heard read by Mr. McIntosh.

The President: I am sure Mr. McIntosh deserves an expression of our thanks. He has worked hard at this work. It is a huge question and one very far reaching. Mr. McIntosh has devoted himself very carefully and thoroughly

to the work. Those in favor of this motion will express it by the raising of their hands. (Loud applause).

MR. MCINTOSH: I assure you I appreciate this vote of thanks very much. I will endeavor to get the very best results possible.

NURSERY STOCK—ITS SELECTION AND CARE.

J. W. CROW, HORTICULTURIST, O.A.C.

I wish to address myself particularly to one point in connection with nursery stock, and do not propose to occupy your time with a full discussion of the subject including the care of the stock. I want to speak regarding the question of one year old trees, or rather the question of low-headed trees. It is rather a leading question with the nurserymen, and it has come to be a much more important question with many of the more up to date fruit growers. Now, for myself in planting an orchard I would want a low-headed tree, and for my own purposes do not care how low it is. I would be satisfied with a tree that had a trunk, say one foot long of even less. That will be considered radical by many people who are accustomed to trees with five or six foot trunks. I do not see what use a tree has with a trunk more than one foot or eighteen inches at the most. You can modify that if you wish. When you go to a nurseryman to select a one-year-old tree you will have difficulty in finding a tree that is low enough to suit the requirements mentioned. Nursery trees usually have a trunk of about two feet or two and a half. That is about the best you can do; and a great many are headed so you cannot get that. Under present nursery conditions, if you want a low-headed tree you have to buy a one-year-old tree. You can head that off any way you like and grow a head to suit yourself. Now, the nurserymen object rather strongly to the necessity of digging one-year-old trees. They do not like to dig them or sell them, and from their side of the case they know what they are at; but at the same time, I believe there will be a growing and increasing demand for this class of stock. Now the question is, what are we going to do? The fruit growers want them and either some common ground must be found somewhere on which they can meet or one side or the other is going to give in. Personally, I think there is a way out of it. If nurserymen would head all their trees uniformly low, it would be possible to satisfy every purchaser, for the simple reason that the man who wants a low-headed tree could get it say at two years or three years of age, and the man that wants a medium high-headed tree could cut off some of the lower branches and get a medium high-headed tree, and the man that wants a tree headed a little higher can get that tree simply by removing some of the lower branches. I can illustrate probably a little better what I mean. Here is a fair sample of an ordinary two or three year old tree. You cannot lower it except by planting the tree in the ground too deep, which I think would not be advisable. To get a low-headed tree you cannot cut that tree off and re-head. That is not practicable except in a few cases. To get a low-headed tree you have simply got to buy that kind of tree. Here is a one-year-old apple that is strictly first-class, and at the same time our nurserymen object to digging trees at that age. They would rather not sell it. A grower buying stock like that can head it where it suits him. A nurseryman will head it about there, and have a tree next year about like that. A fruit grower will head a tree as low

as he likes and get any style of tree he likes. The nurseryman would head it about where I have my hand—about two and a half feet from the root. This is a one-year-old. I use that for illustration purposes. This will show exactly. Suppose that tree had been headed low, to get a higher tree simply take this off, and there is the tree. It is simple to head a tree higher, but it is harder to head a tree lower. In five years time, it does not make a particle of difference. You can cut off every one of these and have a straight tree. You can take that off and have a high-headed tree if you want it, or take the other one off and have a high-headed tree. It occurs to me if nurserymen would head their trees low down everyone would be satisfied, because the purchasers could get anything they wanted. There are people who want a tree with a four foot trunk, and fruit growers and the members of this Association ought to educate the people who are not informed and teach them better than that anybody should want a tree with a four foot trunk. Some people do, but I think it is an entire mistake. I would like to hear discussed, whether it is practicable for the nurserymen uniformly to head their trees lower. What do you think, Mr. Smith?

Mr. Smith: I think every nurseryman would be delighted to do it if the public wants it. The difficulty is that perhaps 75 per cent. of those who buy off the nurseyman want a high-headed tree, and we must cater to the wants of those who buy our goods. If you can only train those who buy trees that that is the way to do it, it will suit the nurseryman splendidly. We would like to grow a low-headed tree, because it is cheaper to do so. Some people—educated fruit growers—want it low, and perhaps those not so well educated want it higher, so we have to grow what the people want, and it is a pretty difficult job, and I wish you could solve it for us.

Mr. Crow: I sometimes wonder how much influence a nurseyman might have in training the public to the proper kind of fruit trees to plant. I think the majority of people take the nurseryman's word, and the nurserymen, if they care to do, can go a long way to getting people to use a low-headed tree. Why not have the nurserymen combine, and get them all down to a low-headed tree.

Mr. Smith: If the nurserymen realize the influence they have upon the public, I would like to get back at you—do you realize the greater influence that you have on the public over nurserymen. When we make that suggestion people say, "You are trying to sell your goods." But you are in a position where you can influence public sentiment a great deal more quickly and rapidly than the nurserymen. You gentlemen who are interested in the better culture of trees, if you make a public statement to the people and explain in your reports and in your published addresses that the nurserymen are trying to produce a better tree than they have in the past, by getting them lower, you will aid the nurserymen very materially. At present there is an established rule in regard to trees. The catalogues put the trees from five to seven feet. Now, if you head your trees lower, you must reduce the height of your trees in your catalogues and reduce the price. I don't think nurserymen would raise the slightest objection about educating the public to lower-headed trees, because it indicates a more simple process.

Q.—Don't you think with some varieties you would not succeed very well in heading then low. Take the Golden Russet. I have a Golden Russet that will measure thirty-five feet across the tops and you would have them dragging on the ground. And take the Wolfe River, you cannot get that high enough.

Mr. Crow: There is a difference in varieties, but the difference in varieties is not so much as to effect the general problem.

In so far as the influence of myself and other men who are in the same line of activity is concerned, it is probably correct to say we have more or less influence with the public, at the same time, I believe the nurserymen have a great deal of influence as well. How would it be if the nurserymen and the professors, as you call them, would work together. Don't you suppose we could prevail on the general public to buy and use and be satisfied with lower-headed trees.

Don't you think that if the nursery agents had low-headed trees to sell they could find arguments in favor of those which would probably induce a large number of buyers to take them?

MR. SMITH: I think there is a point in regard to this that is being overlooked. A very large portion of the market of nursery stock is outside of fruit growers, and when you go to a farmer who knows comparatively little about trees and fruit growing and tell him you have got a three-year-old peach tree to sell for twenty cents and a one-year-old for fifteen cents. He will take the three-year-old every time. He wants size. Another point in regard to the height of a tree, they want to get their horses under it. They don't know how you are going to plow under those trees. I don't think it is possible to do business with that class of customers and sell them the article that the fruit growers want. I don't think it is possible. It is simply a case, if it gets down to that, that he is not going to have it—he is going to cut it out.

Q.—What do you mean by a high-headed tree? The stem is about two feet six inches, I suppose, or thirty inches. You recommend about one foot six inches as I understand it or even lower. Suppose you take one foot six inches, the difference is one foot. Now what great difference is there going to be in that tree when it grows up, whether the limbs are six or seven feet from the ground, or whether five feet or four feet. There is only one foot difference in the trunk of that tree. And if the difference in the trunk makes the difference in the height of the tree ultimately, then there is only one foot difference in the height of the tree.

MR. CROW: If you take the case of apples, and you have to hire men to pick apples, you know that every foot a picker has to climb up a ladder adds to the cost, and it takes just that much more money and it adds to the cost. You will find there is a difference of dollars and cents if you take into calculation the extra foot you have to climb.

A tree can be low-headed with a trunk of six feet. It is largely true that the form and height of a tree may be determined after planting. I think, however, that a low-headed tree offers much greater facility for the proper training and proper forming of the tree than a high-headed tree. I think in buying trees you should take in question both the height and caliper measure. For my own part, if I were buying trees and putting my own money into them, I would go to the nursery and see the kind of stock and pick out the kind of stock I wanted.

MR. SMITH: If all our customers came to the nursery how much time would the nurseryman have to get out his stock?

MR. CROW: I have done that several times, and so far I have always found the nurserymen perfectly willing to give us what we wanted. I believe in many cases it would be worth a man's while to go to the nursery to pick out his stock.

MR. MORRIS: In buying stock we must consider not only the height, but the caliper measure. Now so far as I can see unless some agreement can be come to on the point, the only way for a man who wants low-headed trees is to

buy them one year old. Would it not be fair to say why the nurserymen don't like to sell one-year-old trees. Regarding the man who comes in and wants one-year-old trees, I would say that the nurseryman doesn't want to dig them with a spade if he can possibly avoid it. If he does, he injures the trees on either side of the one that he is digging, or checks their growth, and he spoils a lot, so that the trees that are left over are not in first-class condition for making growth the following year or following season; that is one of the great objections to digging one-year-old trees. If the nurseryman could clean out all his stock in one year it would be a different proposition.

Q.—Cannot you get a low-headed tree from what you call seconds. You haven't said a word about the root of the tree—all about the stem. The root I should think would have something to do with it.

Mr. Crow: You don't get a low-headed tree from a second, ordinarily, for the reason when a tree gets to a certain height in the nursery it is headed off. If it does not get there the first year it does the second year, and you are simply a year behind the programme. In regard to the root of the tree, there has of course to be borne in mind that the vital part of the tree is the part you put below ground when you plant it. The most vital part is the root. You must have some top, but without the root you haven't got a tree.

There is one point that has not been mentioned which probably might be. I know a number of buyers who have gone to nurseries to select their own stock, and who have asked the nurseryman to leave these side branches on instead of having them all cut off up to this point or higher. These branches can be made use of in forming the head of the tree. There is a point there which might be worth considering if the branches are left on down low, there is the foundation for a good low-headed tree, as good as any man would want. If you want a high-headed tree cut that off, and if you want a low-headed tree cut off the higher and leave the low ones. If a buyer of nursery stock would state his requirements in this matter, it might be possible for him to come to some agreement with the nurseryman and have these branches left on. A man might order his nursery stock a year ahead in which case the nurseryman could head it at a suitable point.

A question has been asked as to whether or not there is any real objection to cutting off the entire top of this tree and make it throw out a new branch system. I have seen cases where that has been done successfully. In general, I doubt if it is an advisable method to follow. I think you will lose quite a percentage of trees, and I think the trees which do branch out will not be likely to give you a well formed head. I would rather not do it.

Mr. Morris: You say some fruit growers have gone to the nursery and requested that some of the side branches be left on the side of the tree. One of the first things a nurseyman does in the spring of the year is to rub off the buds. The reason for that is it is a great deal cheaper to rub off the buds than to use a knife in cutting off the branches. I do not know of any nurseryman that would leave the branches on the stem of a tree unless he was caught by weather or climatic conditions or shortage of help, because his trees would be unsaleable. There is absolutely no demand for a tree with the branches on.

Mr. Crow: In the particular cases I have in mind the orders were placed sometime in advance and it would be possible there to allow the side branches to grow.

Mr. Robertson: It is a vigorous tree we want, and we certainly have failed to get vigorous trees during the last ten years; that is the result of methods

introduced by nurserymen in order to possibly lessen the cost of production. We used to plant trees, and we could count on ninety-nine out of one hundred not only living, but giving us a vigorous growth. Now if we only get two-thirds of them that live, and put on a growth of two or three inches the first year, we consider that a success. I consider that is due to winter storage, and partly by spraying and careless trimming, and their method of exposing the trees unnecessarily to the air. We don't get value when we buy trees.

Mr. Crow: I am quite certain if you would buy a low-headed tree you would not have any of this difficulty.

Mr. Fisher: I am very much in favor of low-headed trees, and the reason is because I think they are more profitable. They are easier to trim, easier to spray, and easier to pick, and they are more sightly. The picker will save half an hour in a day's work handling a sixteen foot ladder in place of an eighteen foot ladder.

NURSERY LEGISLATION.

Dr. C. Gordon Hewitt, Dominion Entomologist, Ottawa.

The immediate reason I am here is that owing to recent events in Nova Scotia, namely, the discovery of the San José scale there, we have had rather an upheaval in that Province which has been rather satisfactorily settled. You must pardon me if I refer to what happened in Nova Scotia in reference to the San José scale. Up to the 15th April last, we in Ottawa, and no doubt you in Ontario, and certainly those in Nova Scotia, were dealing in ignorance of the fact that San José scale was in Nova Scotia. They all thought like British Columbia, that they were free from the scale, but one morning one of my men in Nova Scotia came across some nursery stock, and he having had three years' experience in nursery inspection in Illinois, was surprised to find San José scale on this nursery stock, and telegraphed to me as to its presence. I immediately instructed him to make inspection and to send specimens up to Ottawa, which he did. Though we tried to keep the discovery as quiet as possible, one cannot control a matter of this kind, and it got beyond our control. The people got frightened in suddenly finding that it was there. During the summer a thorough inspection was carried out by the Dominion and Provincial Departments of Agriculture of all the nursery stock which had been imported from Ontario, and from the United States to Nova Scotia, and I have here the results of that inspection. The numbers may seem small, but in view of the fact of what we know of the prolific character of the San José scale you can easily realize the disturbed state of mind of the Nova Scotia people in regard to this matter.

In 1910, they found that of the total number of properties carrying outside nursery stock, 247, there were 3 properties carrying infected stock, stock infected with San José scale, living or dead; in 1911, 71, and in 1912, 711—a total of Nova Scotia properties carrying stock infected with the scale either living or dead of 785. I realized that this might only be dead scales and that they had been killed in fumigation. At the same time I gave instructions that a very careful outlook be kept for the living scale, and such a lookout was kept. In 1910 stock, living scale was found on three properties, in 1911 on 71 properties, and in 1912 living scale was found on 127 properties, a total of 201, and the people were very much perturbed. Of course all these trees were destroyed. The Provincial Department

of Agriculture dealt with it as a Provincial matter and had them destroyed. As they had the power, the Department felt that they should carry it out, and the infected trees were destroyed. Now the estimated ratio of trees of 1912 planting which were infected was 30 per cent. The number of nurserymen shipping stock infected with living San José scale into Nova Scotia was 8. These infected trees, trees with the living scale, came from Ontario nurseries. I am not going to mention any names, because that is neither necessary nor advisable, and it would not be just to the nurserymen themselves; but all these infected trees came from Ontario nurseries. In no case was living scale found on trees coming from the United States. That is for two reasons—all trees in the United States imported to Nova Scotia go through the St. John's fumigating station where they are fumigated. It was found in practically every case that they came from nurseries which are inspected by officers of the various States. Probably every State of the Union which has nurseries, has very strict inspection laws, and they have to have the nursery stock inspected and are not allowed to ship the stock out of their nurseries without the inspector's certificate showing that the nursery has been inspected at different times and found practically free from scale, and after that has been done as an additional precaution it is fumigated at St. John's. Now, the infected stock came from nurseries in Ontario. You have in Ontario a regulation that nursery stock shall be fumigated. We have evidence here in this Nova Scotia enquiry that these regulations are not always carried out. In most cases the trees showed signs of fumigation, and a large proportion of the trees of 1912 planting showed most of the scale to be dead. It was common to find only one or two trees bearing living scale in a lot of a hundred, while often 50 to 60 per cent. bore dead scale. Only one lot apparently arrived in 1912 which had not been fumigated. Lots of one variety from one nursery almost invariably bore living San José scale. Whenever scale was present on this variety, it was alive, and on the more heavily infested lots there was no dead scale beyond the ordinary winter kill. In one lot of a hundred of these trees, the inspectors destroyed 25, the highest percentage found. They were not carrying out properly the regulations as to fumigation. As I have said, that naturally created a very highly-inflamed public opinion in the minds of the fruit growers down in Nova Scotia. Not only have they a fruit growers' association down there, but in practically the whole of the Annapolis and Cornwallis Valleys, they have co-operative societies in different towns, and the different societies are united in one company, known as The United Fruit Growers' Company. They passed a resolution calling upon the Provincial Government to absolutely prohibit the importation of Ontario stock. I felt in view of what their experience had been, they had some justification for complaint, and that it was an inter-provincial matter, and a very serious matter, and I felt that such measure was too stringent altogether for the circumstances which had to be faced. Nevertheless, the Provincial Government was in that quandary, and the Premier called a special meeting at Kemptville last month to reconsider this thing, and they asked me to come down there to see what could be done and to try and reason with the people. These fruit growers brought in a unanimous resolution asking that total prohibition of the importation of nursery stock from any infected province be granted—that is from Ontario. They did not specify Ontario, because they simply excluded Ontario. Not only that, but every co-operative society sent in delegates instructed to vote for that resolution, that was the condition of that meeting, and you may imagine it was a very interesting one. I pointed out the success which the Dominion Government had had in dealing with the scale in Canada, and I pointed out to them that such

a resolution was not justifiable unless it was felt that they could not deal with the situation in any other way. We had some such motion in 1898, when the Dominion Government was called on to prohibit the importation of nursery stock from any infected country, and the request was so strong and so urgent that the Government passed the San José Scale Act in 1898, prohibiting the importation of nursery stocks of trees of any kind, which shut off the United States stock. In 1899 they regained their senses, and saw what a quandary they had put themselves in, and asked that to be repealed with the resolution in 1899. I was asked if that embargo was removed, and stock allowed to come in subject to fumigation will you guarantee that every scale will be killed by fumigation, and I said no man will be such a fool to give such an assurance. I will give you my experience that during the eleven years the Dominion Fumigation Stations have been running no scale has been found to come from this stock. In no locality has living scale been introduced by stock fumigated there. In every case where scale has been found in a new locality it has always been introduced from an infected locality in Ontario. I pointed out to the people of Nova Scotia, surely you would be willing to give Ontario stock the same treatment. Well, to make a long story short, they finally withdrew this resolution asking for the prohibition, and calling upon the Provincial Government immediately to take such means as would prevent the further introduction of the San José scale. On their initiative the Provincial Government did pass an Act last year, requiring two changes; first, they required as to every shipment of nursery stock coming into Nova Scotia that a certificate shall accompany it stating that the nursery from which that stock had been shipped had been inspected from June 15th, to September 15th previously, and had been found free from scale. They limited the period of inspection to three months, and when they informed me as to the nature of their resolution I immediately telegraphed them, but it was too late to change it. I think that three months is a rather short time to carry on the inspection of nurseries. The real point was this, by showing they had assured themselves that they are starting with stock free from scale, they assured themselves that the Ontario Regulations are being carried out, and that they should make the same regulations that British Columbia does in regard to fumigation, and they are going to fumigate themselves all stock coming in from Ontario.

You will see as far as the Dominion Government is concerned, they have done everything in their power to help on matters in connection with both the provinces and to make matters run smoothly. They have succeeded in preventing the prohibition of the importation of Ontario nursery stock into Nova Scotia, and I think and hope this general discovery, this general outcry will produce better conditions here in the nurseries which will ultimately mean the commendation of the nurseryman's stock and be a benefit to the nurserymen themselves. Incidentally, this question has also resulted in the appointment in Ontario of a Provincial Entomologist, which to my mind is also a very satisfactory result. I want to refer briefly to the new regulations of the United States Department of Agriculture. I don't know whether any of our nurseries in Canada ship into the United States. If they do they will will be interested in learning that it will be necessary for them to bear these regulations in mind. The United States Department of Agriculture require a nursery inspection certificate similar to that required by many States. That is, if an Ontario nurseryman is going to ship into New York State, he will need to have his nursery properly inspected by the Provincial Department of Agriculture, and the necessary certificate issued under the signature of a duly qualified officer, and then also the United States importer

has to comply with very stringent regulations. Regarding the importation of stock as you know, all nursery stock coming from Europe or Japan or Ontario is inspected either at the destination in the case of Ontario stock, or at the port of entry in the case of European stock that is being imported. The Dominion regulations require that the importer shall send within five days of depositing his order, a notice to the Department, the number of plants he has ordered, the kinds, etc. In many cases that is carried out quite smoothly without any trouble from our end. I am sorry to say in a large number of cases and from some of the largest nurseries in Ontario we have to continually call the nurseryman's attention to the necessity of complying with these regulations. This year we took the following precaution, that wherever we had not received notice of the shipment of nursery stock that arrives from any one who knows the regulations (having had a copy of the Act sent him) we instructed the Customs Officers to refuse its entry. We think that is the best way of enforcing these regulations. Every one must agree that the requirement is a slight one which requires that notice shall be sent, and that it is not half so onerous as the requirement of the new Act in the United States. The United States Department of Agriculture requires that every man who imports nursery stock into the United states shall send them a notice giving the total amount of the shipment, what they are going to import, and when that is received the Department issues a permit allowing the goods to enter the States, and no nurseryman unless he has a permit from the Agricultural Department to do so, can obtain entry of his stock into the United States. That permit is issued in triplicate, one copy kept in Washington, one copy sent to the shipper, and a copy sent to the Customs official, and the Customs official will not allow importations of nursery stock to come in unless he has obtained a permit. You can see the stringent character of these regulations, and compare them with our requirements. Our requirements are not half so stringent. All the importer has to do when sending off his order is to make a copy and send the copy to Ottawa, and we keep that on file. It is allowed to go to its destination, and there we inspect it at its destination. It seems to me there is no excuse for failure of importers to comply with our regulations, in view of the fact that they are of so simple a character.

Q.—What does the Department at Ottawa do when they receive a copy of the order

Dr. Hewitt: They are all filed in our office, and when your stock arrives and you notify us in accordance with the regulations that they have arrived, we know exactly what you are getting, and in that way we can trace them to each customer's hands. If we did not have that notice we would not know whether the stock had come in or whether the stock has been inspected. The United States do not allow a man to import until he has obtained from the Department of Agriculure permission to do so. I might tell you we found on the Japanese stock eggs of the Gypsy Moth; they were simply swarming. You see the necessity and importance of our having this information in regard to what stock is coming in; otherwise we are not able to keep tab on it, and should stock come in infested we have knowledge of it. Now the custom officials notify us as an additional check, and also give us an opportunity to say whether that stock should be allowed in. Last year we had to prohibit the delivery of several shipments because the regulations had not been complied with.

Mr. Morris: I would like to ask without any disrespect to our Provincial Department at all, because I believe they have been thoroughly conscientious and

honest in their work—and on the other hand I believe if there has been any irregularity in this respect on the part of the nurserymen it has not been intentional but has been a miscarriage, just the same as sometimes takes place in our Courts of Justice—would the Dominion Government consent to use their influence to get Nova Scotia to accept the Dominion fumigation of stock, the same as it accepts the Dominion fumigation of stock from the United States, and elsewhere?

DR. HEWITT: That question has not been up for our consideration.

MR. MORRIS: Would the Department consent to consider that question if placed before it?

DR. HEWITT: I think it would. The Department's policy as to this question is rather the other way—the Department's policy in regard to this question of regulating importations and fumigations is rather the other way; that is, relegating the powers to the Provinces rather than assuming it. In the case of British Columbia, up to the last Parliament the fumigation was carried on both by the Dominion Government and by the Provincial Government, that is outside stock, not Canadian stock—stock from the United States. They fumigated outside stock and we fumigated it. There was constant fumigation and constant friction, and to put an end to it we made a new agreement with the Provincial Department of British Columbia whereby our regulations are carried out by them. They have the same power we have, and they carry out the regulations. I mention this to show that rather than the Dominion Parliament assuming these powers our policy is to relegate them to the Provincial Department.

DR. HEWITT: In some States the nurserymen have to have their stock fumigated twice. Some States have the same regulation that you have in Ontario requiring the fumigation of stock. Some of them, but not all of them. In any case they start with a certificate that the stock is free from scale—accompanied with that certificate.

MR. MORRIS: The Ontario nurserymen would like to avoid the second fumigation of their stock if it could be possibly arranged, and the way to do that it seems to me is to have the stock fumigated under the supervision of the Dominion Government in this Province previous to its leaving here, thus avoiding the breaking of packages and also the bundles in their examination, and having the great delay that is experienced by the Ontario nurserymen in British Columbia. The nurserymen to-day have withdrawn almost entirely, if not quite, from doing business in British Columbia on account of their drastic regulations.

DR. HEWITT: Your suggestion is that the fumigation should take place at the point of shipment, and that the fumigation should be carried out by the Dominion Government.

MR. MORRIS: And should be a final fumigation.

DR. HEWITT: I do not know whether the Dominion could exercise such powers over the Provincial department as that.

Q.—Is there any guarantee that this same stock with scale that has been going over Nova Scotia has not been sent out through Ontario.

MR. HODGETTS: We have had cases where Ontario stock coming from the nurseries has been found infested with living scale, and we have either destroyed the stock or treated the scale, but we have never had as bad instances as those reported from Nova Scotia the last three years. We have no bad cases where the scale has spread into new districts from infested stock—practically all has spread from the orchards that were infested when the scale came in first from the United

States. We hope now, under Mr. Caesar's charge, we will be able to get a proper staff organized and look after it better than we have in the past. We think the nurserymen shipping into Nova Scotia should be granted a certificate. The same regulations will apply to stock going into Ontario as applies to stock going into Nova Scotia, we think certainly the interests of both the Ontario Grower and Nova Scotia grower should be protected.

MR. MORRIS: What were the total number of trees in Nova Scotia found infested with living scale?

DR. HEWITT: In 1910 three trees; 1911, 71; 1912, 127; total 201. The total number of properties carrying outside nursery stock 1,744. Total number of properties carrying stock infected with San José Scale living or dead for the three years 1910, 1911 and 1912 was 785, the total number of properties carrying living San José Scale for the three years was 201.

MR. MORRIS: The number of trees destroyed I think was approximately 600 trees.

DR. HEWITT: Yes, 693 trees destroyed.

MR. MORRIS: When you consider there were 157,000 trees examined and out of those between 600 and 700 had live scale, and probably many of those with only a few—it was a very small percentage.

DR. HEWITT: I agree with you.

MR. MORRIS: And Dr. Matheson said that fumigation would probably kill about from 96 to 98 per cent. of the scale under the most favorable kind of fumigation, as is general and customery. So I think Ontario nurserymen are not quite as black as would appear, because out of 157,000 trees only 600 or 700 trees were found during a period of three years to be infested. That is not very bad, but of course it is bad enough.

DR. HEWITT: It is bad enough for the Nova Scotia people, and of course some of the Ontario nurserymen did not improve matters by writing down to the people there who had infested stock and telling them that they ought to be thankful that they had got the scale stock as they would spray better, have better trees and better fruit. Some others wrote down and said they had absolutely no scale in their nurseries. The fruit growers of Cornwallis Valley and Annapolis have letters of that kind, and you can imagine how it kindled the flames. From my experience in fumigation, a second fumigation if the trees are in a dormant state and dry will do no harm. If the trees are wet, or if the trees are putting out their leaves, it is likely to do damage. If the trees are shipped in the dormant season and fumigation takes place when the trees are dormant and dry, I do not think a second fumigation will be injurious. What we do in the case of Dominion regulations is, that if trees arrive late in the season, in the leafy season, if the buds are beginning to burst and leaves are beginning to form, and if there is any danger of fumigation, we inform the importer we will fumigate them at his risk, and if they won't take the risk, the trees are not allowed to go through.

Q.—The subject under discussion in Nursery Legislation. May I ask, if you are going to confine the remarks to Nova Scotia, whether Nova Scotia fellows have legislation that the trees should be true to name. We can control legislation as to scale and not as to the name. Trees formerly were true to name. In a few cases we would get a tree or two that was something else. In every case it was a good graft. To-day we take out from 30 to 40 trees every year—as trees come to bear—all trees that are not true to name. They are absolutely worthless varieties—clingstones.

I have, perhaps, thirty or forty of them to take out this fall. They are white flesh clingstones. These have not come from any particular nursery. They are from different nurseries, and I think it is certainly time for this Association to take some steps to get the nurserymen to act with the fruit-growers. If they have to have more money for their trees to supply us with stock they can guarantee I think the growers would be in favour of that. There should be some class of stock that they can guarantee. I think things are getting worse. And I think it is a subject that is worthy of discussion.

THE PRESIDENT: I quite realise in listening to the discussion that it seems to be very important that the nurserymen should be controlled in some way in regard to the products that they are sending out through the country. Mr. Smith raised an important point when he asked if the nurseries of Ontario were sending products around the country—trees infected by the scale. If they are, we do not know where it is going to end and how far it is going to go. The question is brought up as to whether the trees are true to name or not. I believe there is a wide feeling, and a serious feeling, among the fruit-growers in regard to this matter, and many trees are received which are not true to name. A man told me the other day that he thought he had only three or four varieties, and he found that the most of them were not true to name. I find in my own peach orchard—an orchard I have taken a great deal of pride in and care in planting—that two rows from end to end of that orchard are absolute trash, and in fact not good for anything, a disgrace to the orchard. In my county of Lambton the last few years several hundred thousand of trees have been planted out, and I rather think it would be a wise thing to submit this to a committee and let them take it before the resolution committee and let them discuss it. I would suggest that those present interested in the matter appoint a committee and let it go before the resolution committee and discuss it in the afternoon. While that committee is being formed I would ask if Mr. Caesar has anything to add in view of the discussion that has taken place.

MR. CAESAR: I think the less I say at the present the better. I am trying to absorb the ideas or to grasp the situation as well as I can, and would like to think over it for a considerable time. I have been looking into the nurseries, and I have been consulting the different inspectors in regard to the different nurseries and their condition, and am feeling my way gradually to better nurseries—to secure clean nurseries. But it is a great big problem and a very difficult one, and much more difficult than I used to think it was once. It seems to me that a person should be very very careful not to make suggestions off-hand, and for that reason I do not care at present to make any proposals before this meeting or discussing the question very fully until I have satisfied myself as to the wisest methods involved, and after consulting with a number of others in regard to this matter. I enjoyed very much hearing the nurserymen's views in regard to these matters. I know that question of double fumigation is a great big problem. We have the statements of men like Professor Hendrick, of Geneva, that if he had his choice he would never have stock fumigated at all. Then, again, we have the statements of other men just as great horticulturists, perhaps, as Professor Hendrick, that they think fumigation has no injurious effects on nursery stock, provided it is done with ordinary precaution, and that the trees are at a proper stage for it. To get to that stage it is difficult. If stock is shipped to Nova Scotia, one can easily sympathise or can easily feel how hard the Nova Scotia Legislation will hit nurserymen, provided they do not make any alterations—alterations which we would hope would be equivalent to the present measures. I do not feel like making any suggestions at the present moment in regard to these things.

Dr. Hewitt: Before the meeting closes I should like to say, in order that there may not be any misapprehension that I am quite in favor of the system of inspection and fumigation going together and being carried out in the nursery. That is, of a system of inspection of the nursery, and a certificate issued that the nursery is free from scale; also that every shipment of stock going out from that nursery should be fumigated. I think that is the system we should try and get. Every nurseryman should carry out that, and have the foreman see that the men who do that work do it properly, seeing that all stock going out is properly fumigated. I know the nurserymen themselves are anxious that their stock should go out clean, but they usually leave the fumigation to the foreman and men. If the men are anxious to carry out these regulations and anxious to ship out stock free from living scale that would be the ideal system. Then we may have this inspection of the nurseries and the fumigation at the nurseries, and do away with this discrimination and this second fumigation by other provinces—by both Nova Scotia and New Brunswick. That system would be an ideal system, and I for one, more than anyone else, would rejoice to see such a system universally adopted. But as far as we are at present concerned, you will understand that it is impossible, in view of the fact that the present requirements are not now carried out sufficiently, and the British Columbia and the Nova Scotia people have found out that living scale was being imported. If that had not happened, in neither case would the fumigation of Ontario stock or of New Brunswick stock or any other stock have been carried out, and we must hope that in the future—and near future—we can so arrange things and so have our provincial systems and inspections so guaranteed that one Provincial Government can accept the certificate of the other Provincial Government. When that arrives then I am sure that the whole thing will be settled, but not till then. You must understand the present circumstances do not permit any Provincial Government to do otherwise than they have done. My sympathies are very much with the nurserymen, because I know the difficulties they have to contend with.

Q.—Supposing a one-year-old tree was affected, and other healthy trees planted say thirty feet apart, which is likely to happen, would the scale kill that tree or the scale spread from that tree to other trees first? I understand the scale is almost fatal within a year or so?

Dr. Hewitt: I think if the tree were infested with the living scale it would be more likely to kill that tree.

Q.—In the cases you found in Nova Scotia, were there evidences of the scales having spread from one tree to another at all?

A.—No.

Q.—Not even on three-year-old trees?

A.—No.

Q.—It was confined in each case to the original infection?

A.—Yes.

Q.—The point I want to know is, in a young orchard is there a likelihood of the scale spreading?

A.—I think there is; yes.

Q.—I can easily understand in an old orchard, where the trees would be nearly meeting, the danger would be very great, but where the trees are young and well apart and the ground is under a hoe crop, is there any likelihood of it spreading?

A.—I think there is. There are many things that will carry it—flies, bees, lady bugs and the feet of birds.

APPLES.

J. R. Anderson, M.P.P., Leamington.

My first word this afternoon would be to congratulate the Ontario Fruit Growers' Association in the magnificent success of the show, which I have had the pleasure of visiting, over in Exhibition Park this morning. I also desire to congratulate the Ontario Fruit Growers' Association on the activity they have displayed in assisting, and being a very important factor, indeed, in the building up of the fruit industry in the Province of Ontario in recent years. I am to speak regarding the best six varieties of apples. The Fruit Growers' Association have committed themselves to the problem of the better growing of apples, and the great activity they have displayed in that regard has brought us face to face with another problem, and that is the problem of over-production. It seems to me that apples to be grown at a profit in the future must be apples that will command the attention and the demand of the buyers, both in our own West and in the markets of Great Britain, because that is where we must seek an outlet. At the outset I may say I do not expect that all the growers in this room will at all agree with the varieties that I have selected. The first variety I would select, and the first maturing variety, would be the Wealthy. Now, to my mind the Wealthy is one of our very best early apples, in fact the best. It is the most productive, and it is an apple that requires to be grown under proper conditions, as every other apple requires to be grown. They must be thoroughly pruned and thinned on the trees. You cannot grow Wealthies successfully unless the trees are not only thoroughly pruned but thoroughly thinned as well. It is just as important as thinning a field of turnips. They are popular both in European markets and in our western markets. There is a decided demand for the Wealthy variety, and so I begin with the Wealthy.

The next variety I would name is the Snow or McIntosh. You can choose between the two. They mature after the Wealthy apples would be harvested and marketed. They are also popular in both markets and a safe proposition, and you can make your choice between the two. They will be a profitable apple to grow in the future. The next variety would be the old standard variety of King. I hope the growers of Ontario will never cease planting Kings. They are certainly popular in any market. It does not matter where you go you can always sell Kings, and always will be able to sell them. Some objection may be taken that they will not be a profitable apple to grow, but I do not concur in that opinion. You may not get so many barrels but you will have the satisfaction of knowing that what you have got is worth something, which cannot be said of some other varieties.

The next apple in order of merit would be the Golden Russet, another apple which I suppose is not altogether popular with a great many growers. You may think you may not get as many barrels from the Golden Russet trees as the Baldwins or Greenings, yet the Golden Russet is one of the most popular apples in the market of Great Britain. If you cast your eyes over the market reports coming from London, Glasgow or Liverpool to-day, when the markets are very much depressed, you will find Golden Russets are returning a very fair profit on the outlay.

I was almost inclined to eliminate the Baldwin, but on second thought I did not see how I could very well dispense with it. For the fifth I would put down

the Baldwin. You can always depend on it. It is a prolific bearer and a standard marketing apple in all markets. My last variety, and I do not think it is the least by any means, would be our old standard, the Northern Spy—the Canadian Northern Spy. The demand is greater, I may say, for the Northern Spy than any other apple, particularly in our own western markets. The Northern Spy is the best apple we grow, I think, and the worst apple. Now, there is a statement and one part directly contradicts the other. Grown under proper conditions with the right kind of Northern Spy there is nothing finer in the world, and nothing more popular in any market anywhere. On the other hand you take a poor Northern Spy, and unfortunately a great many of our growers stick closely to that kind, it is the poorest apple we grow. The Northern Spy without any colour is the poorest excuse for a Canadian apple that is put into barrels and put on the market anywhere. If I might borrow a phrase from my friend Mr. Carey, the Dominion Fruit Inspector, I would say these green Spies lack character. It is a very good phrase, I think, to express the idea, and the sooner our growers get it out of their heads to keep putting them up in barrels or boxes the better. I do not suppose they put any in boxes. The sooner they get it out of their heads to pack these poor colored green Northern Spies the better it will be for themselves and the better for the Canadian market. If the growers of the Province of Ontario could only appreciate what our Canadian apples have got to contend against, particularly in the western markets, they would be ashamed of the apples that I have seen in barrels in the markets of our Western Provinces, when they are compared with apples received from British Columbia, Oregon and Washington. Every apple is wrapped, and our stuff shows up as badly as it possibly can in many cases, and it is no wonder that that market is slipping away from us. If we do not waken up some fine morning that market will be gone from us permanently. They do not want our green Spies in that market, but they want our good ones, and they want all we can grow. If the Minister of Agriculture is present this afternoon he can do no better work for the apple industry of the Province of Ontario than by carrying on experimental orchards and demonstrating how to grow perfect specimens under perfect conditions, and send that information to the fruit growers of Ontario. There is a certain kind of Spy that I think must be grown under too intense cultivation which grows very coarse and large, and has not a good color. There must be conditions under which we can grow Spies something like we saw over in the Exhibition Park this morning, highly colored specimens. That is what the market requires.

I have given you my idea of six varieties. I know all of them will not meet with your views as to what is best. Perhaps it is best that it should not or there might be an over-production in those varieties, but if the apple producers of the Province of Ontario will stick fairly closely to those six varieties and produce them to perfection they will not make a very great mistake.

W. T. Macoun: The only change I would make to that list is the Rhode Island Greening to take the place of the Golden Russet. The reason I make that suggestion is this: The Province of Nova Scotia grows, in my judgment, the finest Ribston Pippin, Golden Russet and Roxborough Russet in Canada, and they have an immense number of trees of those varieties. It seems to me they will in the near future pretty nearly supply the market for that type of apple. Now, I do not know any part of Canada where a Rhode Island Greening is grown so well as in Ontario, and I believe that that would be a more popular variety than the Golden Russet.

MR. R. H. MCCURDY: I feel like saying I think some of the varieties that we call colored varieties, not the very high colored, and long keeping varieties, stand up well for the export market, and can be raised for about half the price or half the cost of the others, and would pay, although I do not say, don't put in better varieties. I will name one, the Gale.

A MEBMER: I think that is a very important point about the Golden Russet and the Greening. I think it would be a very nice thing as there are a large number of growers here if they would say which of those apples they would prefer put in this list.

A MEMBER: The Ontario Russet is worth about two of the Nova Scotia Russet. One barrel of Golden Russets from one end of the season to another will usually bring on an average about as much as two barrels of Greenings. I do not see why the Golden Russet should not be left.

MR. PEART: The locality has a good deal to do with it. In the Georgian Bay district I am told the Ben Davis answers the purpose. Down east in the Trenton district a great many fruit growers tell me they make money out of the Ben Davis, and also in the West and Northwestern part of the Province. In the district where I live I do not know a single man who is planting the Golden Russet. They think there are some other varieties they can plant to better advantage. Speaking for myself if I plant apples next spring I will plant a lot of the varieties mentioned by Mr. Anderson excepting the Golden Russet, and I would substitute for it the Ribston Pippin.

MR. W. FISHER: I see some nurserymen here to-day and they could tell us how much demand there is for the Golden Russet.

MR. HAMMOND: I have just spent about seven weeks selling apples in New Ontario and Quebec Province, and the apple I had the greatest trouble getting rid of was the Greening. Now, if the Greening had another skin on it, one of a different color, it would be one of the most ready selling, but as it is it is one of the most difficult to sell. I know that from practical experience. If I were to substitute one for the Russet or Greening I would name the Stark.

MR. G. C. CASTON: Greenings grown in the Georgian Bay district are winter apples, and they keep till spring. Regarding the Russet it is regarded very unfavourably in our own country. It will not stand the least bit of warmth. With the least bit of heat the Russet will shrivel, and at the same time it loses its flavor. If it is kept in cold storage it is a good apple, but it is a poor bearer. I would not invest in Russet trees if they gave them to me for nothing, and I have been growing them for thirty years. I think the substitution of the Greening for the Russet is a very good one. The Greening is one of our very best winter cookers. If there is anything better in the way of a winter cooker I would like to know what it is. The Ben Davis is a very handsome apple but a very short lived tree. The Northern Spy is king of them all.

MR. WILSON: What is the Jonathan apple like? I see in Chicago it is very popular and is recommended very highly. If it is good for them it ought to be good for us.

MR. DEMPSEY: In Ontario the Jonathan is a much smaller apple than the Snow. It is exceedingly handsome and is ready for use in February and March. It is a very nice apple, and very productive. Possibly if it were thinned and the tree cut back you might be able to grow them all right. As far as the King is concerned I am willing to admit it is one of the best apples from the buyer's standpoint, but

from the grower's standpoint it is not worth anything. It takes about 75 trees to get one barrel. As far as the Golden Russet is concerned I have found it a very sectional apple, only succeeding in a few places, and where it does succeed it is certainly a profitable apple. The King is a full brother to the Ben Davis, but it is a black brother. I wouldn't want anybody to plant it.

Mr. Brown: I put out a year or so ago between two and three thousand trees, and four of the varieties mentioned here I chose amongst my leaders, the Wealthy, the MacIntosh, the Baldwin and the Spy. I put in enough Kings to say I had some Kings there, because the King is an apple that carries a name with it. If I want to sell the orchard at any time it is nice to be able to say I have got some Kings. I have harvested Kings for three years now, and I can always pick out a Baldwin tree that has got more money on it than fifteen King trees in my orchard. I did not plant any Greenings at all. The Russet has not been a profitable apple with me at all. The two varieties that I would choose to fill out the six would be the Blenheim and the Duchess. The Blenheim packs well and is a firmer fruit. It is a strong growing tree, a large apple, and a magnificent dessert apple. It comes at a nice time of the year to pick apples. It has always panned out well with us, what we have packed, and they are over before the other work comes on. I figure that my Duchess will pay for my orchard before I pick a Baldwin or a Spy. It is profitable apples we are discussing and that is my opinion.

Mr. Young: The list that we have confined ourselves to is the Wealthy, the MacIntosh, the Duchess and the Greening. I would like to ask as to the hardiness of the Blenheim?

Mr. Brown: I do not think the Blenheim is a hardy apple. I do not think it is a good proposition outside of Southern Ontario. I may say this much for the Duchess. In Norfolk County they are marketed somewhat before they are in the rest of the Province. I did not know about this last year, but the year before I know our Duchess apples were gone sometime before Toronto Exhibition. When I came to the Exhibition here the only apple that amounted to anything was the Duchess. They were from other parts of the county. The Duchess is an earlier apple with us and consequently strikes the market before the rest of the Province.

The Chairman: This discussion goes to show that while it is desirable to reduce the number of varieties as much as possible there are certain limits connected with the industry which prevent us from laying down any arbitrary rules. I was rather surprised in Mr. Anderson's address that he did not break over the bounds and add two or three varieties to those that he mentioned, notwithstanding that he had been confined to six. It goes to show that we cannot possibly confine ourselves in this Province of Ontario, much less the Dominion of Canada, to only six varieties of apples, but that we must consider the surroundings and the conditions under which we are working, and select for ourselves under the guidance of experienced men such as we have here to-day.

Mr. Onslow: If there is time I think it would be advisable to give the names of three of the best early bearing varieties. In the Niagara district and the southern part of Ontario there is a considerable demand for early varieties to ship in boxes and baskets, and I think it would be well to mention three of the early bearing varieties for the early western market.

Mr. Bunting: Mr. Kimmins has had a large experience both as a grower of nursery stock and also as a shipper of fruit trees, and I would refer that question to him.

MR. KIMMINS: I do not know, Mr. Chairman, that I could name three. Mr. Brown referred to the Duchess. I think if I were advising anybody to plant early apples I would say the Duchess. There is a demand which is growing every year, particularly in the West, and I think anybody who wanted an early variety, and wanted to capture that market ought to grow that variety. We have had no experience in shipping the Astrachan or the Yellow Transparent to the West. Perhaps some of the St. Catharines people have had experience in that respect, but you cannot very well pack the Astrachan in a barrel, and I do not know how they would go boxed. There are not enough of them growing to make any kind of a shipment, but now people are planting the Duchess in sufficient numbers to enable a shipper to gather a sufficient quantity to make up a carload lot.

MR. HAMILTON: We get most profit out of the Duchess, I think, and the St. Lawrence.

MR. HOPKINS: I am a little surprised that the Alexander has not been mentioned. It is good for selling and for bearing. I would like to say something in reference to the MacIntosh. It has been planted very largely and I have been growing it for some years, and I want to say that it is the worst apple to leave the tree that I know of. I have gathered up several bushels under a MacIntosh tree after a wind storm.

PEACHES.

WILLIAM ARMSTRONG, QUEENSTON.

Gentlemen,—I am requested to name six varieties of peaches which I would consider best for what? For a new up-to-date commercial peach orchard. I want you to bear in mind that word "commercial" in all I have to say. After forty years' experience in growing peaches, and especially considering the experience that I have had this last two or three years, I have come to the conclusion that if any young man wishes to plant out a peach orchard—say a young man who has been given $10,000 or $20,000 and who is going to work to put out a peach orchard—I want to advise him so that he will not lose money, but will at the close of twenty years have a competency to retire on if he follows it out. I am not going to give him to-day, though, the full details. I may later on. In view of this experience I will name but three varieties, and these three varieties you can bank on. They are varieties you will have no trouble with. I have selected them for their hardiness, and as to coming in at seasons where they will not overlap too much. If a man has 1,500 trees or 2,000 trees of these varieties, and half a dozen or eight pickers, they can follow this thing up through the season. I want you to remember in putting out this orchard that the peach season is only a short season. It is utterly useless to put peaches on the market when other varieties of fruit occupy that market. It is an infringement on the apple grower for the peach grower to send his peaches right through to November. That is my opinion. The three varieties I shall name I think are fairly familiar to all peach growers. I will begin with the Yellow St. John. There is a glorious peach, handsome, good color, good size, and coming in just when the people want it. We pick them on the Niagara River about the 20th August. Now, that is early enough. It is a grand peach and you can bank on it. It is a money maker, a good bearer. The only feature that is against it, and you will always find some little weakness, is that it is liable to

cluster too much, but that only occurs when it is about eight years old. From that on it is apt to throw out these small spurs about an inch and a half long, and those spurs will throw out four or five buds and you will have four or five peaches. With simply a little extra trouble you can rub them off. Rub the peach off when it is young. This year I have 1,500 Yellow St. John, and I made a nice lot of money out of them.

The next one you are not so familiar with, and in fact for years I did not notice the peculiarities of this grand peach. In fact its characteristics were forced on me, and I had to admit that this middle peach was the best of them all as a money maker—the New Prolific. It is a dandy. The New Prolific produces its bud in double bud. There are two double buds stand out and in the centre is the leaf bud. That is the way to recognize it—it has the ability of throwing out the double bud. A piece 14 inches long may have 40 or 50 or 60 buds on. It is a simple matter in the winter to cut it back to three or four or five buds. I do not think it is necessary for me to speak any further in regard to the peculiarities of the New Prolific variety. You will get through with your Yellow St. John and you will have a few days to spare before it comes in, and just there there is a variety that should come in, but I will leave that for you fellows to fight over. It should be a Crawford. I hesitate to name the variety in the Crawford family that should come in between the Yellow St. John and the New Prolific. However, in my opinion it would be the Fitzgerald. The Fitzgerald has the ability you might say to over-bear itself, and as a result it requires unusual trimming and thinning. Besides that I find the Fitzgerald does not color up quite as fancy as I would like. It is fairly good, and some people get better resutls than I have noticed. Then there is another variety coming in just about the same time, the Garfield, which would come right in there for a few days. Some call it the Brigden. Then there is one more that possibly might be well to have, and that is the Foster. The trouble with the Foster is, it is weak in the bud and it frequently gets winter killed.

Q.—When will the New Prolific come in?

Mr. Armstrong: About the 25th or 26th or 27th August, with us. We are shipping New Prolific on the 1st September, and then on the 5th September we run right into our Elberta. That is the last variety that I will mention. Everybody is familiar with the Elberta. I have been talking to one or two of the principal growers in regard to suggesting a later variety, and it has been suggested one variety a little later might be all right, but I am banking on these three great varieties. You can make no mistake about them.

Q.—What do you say about the Smock?

Mr. Armstrong: It is altogether too late. I think the young man who starts must learn from those who have had experience, and those are two or three varieties that he is absolutely certain of, and he can get them on the market and get his money out of them.

The President: The four varieties you would recommend are the Yellow St. John, the Fitzgerald, the New Prolific and the Elberta?

Mr. Armstrong: Yes.

Q.—What about the Jewett?

Mr. Armstrong: That is an early peach and is fairly good, a semi-free. I would not plant it.

THE PRESIDENT: Down in the Leamington district they think a great deal of the Kalamazoo?

MR. ARMSTRONG: I am not familiar with it.

MR. ONSLOW: It is an exceedingly large peach, and if it is picked a little on the firm side it is very good. It is very tender in the skin, though.

MR. SHEPPARD: I have Niagaras, and my brother just across the fence has Niagaras. Now, he has made more money out of his Niagaras than anything I have got, and my Niagaras are not worth anything. If mine are the right thing then I wouldn't have them, but if the ones my brother has are the genuine article then there is nothing better in the district. I am inclined to think he has not got what he bought as Niagaras. They were got from a nursery.

A MEMBER: I have had very good success with Reeves' Favourite. With me it has been a very profitable peach.

Q.—What do you think of the Oceana?

MR. BUNTING: It is a good peach.

PEARS.

M. C. SMITH, BURLINGTON.

I know it will be a surprise to a good many of you to hear anything from me on this subject. I have been associated practically all my life with apples, but I must admit that if I have a second love in fruits it is pears. I am expected to advise you on the six most profitable kinds of planting. I must admit again I have not done a great deal of pear planting, but I have handled and grown a very considerable quantity of pears in the last eight or ten years. To give you an idea of the quantity of pears I grow, I may say that this year in our different orchards we had of our own growing over five thousand bushels of pears, and I had to buy others in order to supply the demand, and I feel that I know a little about the profitable varieties. If I were to plant myself an orchard at all, I would plant pears. Like Mr. Armstrong here, I feel like cutting down those six varieties to probably three. There are a good many varieties of pears, and one variety might suit one locality better than another. I am sure that the same varieties of pears will not suit all locations and all qualities or grades of soil.

The first pear I would pick out, and I am sure the majority of the people here will agree with me, would be the Bartlett. I would put it first and foremost in value. In quality it cannot be excelled, and in appearance and in yield it is good. It is a profitable pear to grow for our local markets, and a profitable pear to grow for export. It is welcomed and appreciated in our markets. It is a heavy cropper and an annual cropper. The trees are long-lived. Now, I am going to get into trouble on the next variety of pear, the same as Mr. Anderson did on his apples, but sticking strictly to the subject, for profit I have got to recommend the Kieffer. Now, I can see you men smile, but I have got to tell you it has got a lot more merit than some others, and the longer we grow it and the more it is used the more it is appreciated. It is an early bearer and a heavy bearer, and probably the easiest of all pears to take care of. It is uniform, and it has many other desirable qualities. It is not very popular on our local markets except for the canning factories. In

Toronto or Montreal or in other cities they are not appreciated. There is a growing demand every year in England for the Kieffer pear. One of the largest receivers of fruits in Great Britain advises me every time I see him to plant more and grow more Kieffers. He says the more the people buy them the better they like them, and the demand is increasing all the time. The canning factories prefer the Kieffer to any other variety, probably next to the Bartlett, but where they pay three cents a pound for the Bartlett, and I may say that is what I sold mine for to the canning factories here in this country, the canning factories pay one and a half cents a pound on an average for the Kieffer pear. They cannot always get as many Bartletts as they want, and I know a great many pears that are labelled Bartletts that are really Kieffers. They do not always can the Kieffers now, as they did in the past, green, but they allow them to mature and ripen and colour yellow, as they will, and then when they are canned they are marked Bartletts, and sold for Bartletts, and any man who buys them will get just as good value as if he had got Bartletts.

Now, the third variety will be the Duchess. The Duchess is another pear that can be exported profitably. It is also appreciated in this market. It is a fairly regular bearer, and when it does bear it fills up the barrels and boxes very fast for they are very large, and usually an easy pear to take care of.

After the Duchess I am just a little at sea. From the results of my own experience in growing pears I have got to name the Anjou. I know it has its faults. It does not bear very early, and for some people it does not bear very regularly, but with us it has been one of the most profitable pears we raise. Our trees are matured and we get a crop every year. We get a full crop every other year, but a good many pears every year. It is a pear of very high quality and it can be exported, but it is appreciated and there is a considerable demand for it in our own country.

After the Anjou I am still more at sea. There are three or four varieties that I could mention. I would name the Bosc as the fifth, and for the last variety I have got to recommend Clapp's Favourite, although I know I will get into trouble with the people from the Niagara district. I know it spots pretty badly, and probably spots more in the Niagara district than anywhere else, although I will say for those people they can grow peaches. Clapp's Favourite in our section and throughout Western Ontario is a profitable pear. It is a very fine bearing pear and a good cropper. There are three or four other varieties that are very good. There is the Clairgeau, the Bonne, the Sheldon, and the Seckel. I would name for my varieties the Bartlett, the Kieffer, the Duchess, the Anjou, the Bosc and the Clapp's Favourite, for profit, for I believe that is what most people are growing fruit for.

Q.—Is there any reliable early pear that you know of?

Mr. Smith: Nothing earlier than Clapp's that I would recommend.

A Member: The Giffard is pretty good in the Niagara district.

PLUMS.

W. Dewar, Fruitland.

In choosing the varieties of plums you may have great difficulty in getting down to a few. In selecting the best six varieties I had not much difficulty in my own mind with regard to five, which I would recommend from a commercial

standpoint. In growing plums I think we have to consider the canning factory demand more than anything else. Our plums are not eaten out of hand so much as the California plums. The California plums take the precedence on account of their appearance and method of packing. From my point of view, too, we have to base our decision on the growing of a small plum from what you might call a medium sized plum and the larger or fancy plum. That has to be considered in choosing the varieties. You have also to consider from the standpoint of the fruit grower where the most profit arises. I think with plums we should try to get as big a crop as possible with a fair profit rather than try to get a plum of good quality like the German prune which will give us quality but will not pay.

I would start out I think with the Burbank. It is a heavy yielder and a magnificent shipper, and comes in early in the season, and is splendid for shipment to the west and for local shipment. It has to be carefully watched and pruned or else it will get out of hand, but I think the Burbank is worthy of first place. There is one objection to it, it is liable to run to small plums. I understand there is objection in that regard. Next to that I place the Bradshaw. This is a fairly good shipper and if packed firm will stand shipment to the West. It is liable to rot if allowed to go too far.

Mr. Armstrong: It is sometimes called the Niagara.

Mr. Dewar: I believe there is a slight difference. I am not very familiar with the exact difference.

The next I have following the Bradshaw is the Reine Claude. I am probably not taking them in the exact order of ripening. It is a good plum. Following that I put the Lombard. That is the cheapest plum for canning factories and shipping in large quantities, and it is a plum we have to take into consideration because many people who buy plums want the Lombard, and we have to plant it to a certain extent. Then after the Lombard I would put the Monarch as a late plum. It is a plum of excellent shipping qualities, and a heavy yielder. I think the Monarch should be included. Now, those are five that appear to me to be in the list as commercial plums, taking from the beginning of the season to the latter part of the season so that the picking would extend equally throughout. Now, as to the sixth I have some doubt. Taking it from the standpoint of local orders, or the standpoint of shipment to the West, if we looked upon the Western shipments we should include the Shropshire Damson. It is very likely to be overplanted I think. It is the highest priced plum I know of, and there is no telling when the demand will drop. If I were planting with the view of a Western market, I would plant some of them. When I mentioned the Lombard I had great difficulty in deciding amongst three varieties, the Lombard, the Gueii and the Orleans. The Gueii or Orleans are fancy plums if well grown, and you can get a better price for them than for the Lombards; but in a commercial sense they probably would not be placed along with the Lombards. Then the Monarch has two or three competitors. There is the Grand Duke and the Black Diamond, and there may be many others that one would plant, but they would be put in as fillers and I do not think they should displace any of the others from a commercial standpoint.

Q.—What about the Pellenburg, the Italian prune?

Mr. Dewar: I would place it with the German prune. I think it bears very well, but not very heavily.

Q.—What about the Imperial Gage?

Mr. Dewar: That was a plum I intended to mention. I think the yellow

plums should be included for local shipment. The Imperial Gage and the Washington are two I forgot to mention. Of course as I said, I think I would take my other five first, and use the Imperial Gage and the Washington as fillers amongst the others.

Q.—Do you know of any good early plum, earlier than the Burbank?

MR. DEWAR: Well, some people make good money out of the Willard, but I think that is too early for the market. The market is not ready for plums at that time.

Q.—What about the Red June?

MR. DEWAR: I would not include that in a commercial orchard. That is, in picking out five or six varieties.

THE PRESIDENT: I have been growing some myself and we always find the Imperial Gage gives us better returns and better satisfaction than any other plum we grow. We find a great many of our customers want that plum for household canning.

A MEMBER: I think if you would use the Reine Claude you wouldn't use the Imperial Gage.

GRAPES.

F. G. STEWART, HOMER.

I think I will copy Mr. Smith and not take the varieties as they grow, but take them as a commercial crop. The first is the Concord. One of the strong points in that is, that the bud in the spring comes out woolly. If you take a grape like the Rogers with a smooth bud, if it gets a least bit of frost in the spring it goes. You can have a Rogers variety with the smooth leaf and you will find the buds cannot stand the frost, whereas if you take the Concord it has a woolly coat and the frost will stand out on top of it. It grows on sand or clay and makes lots of wood. It is a good shipper. In fact, it is like the Bartlett pear. That is the very best first, I consider, and I have been growing grapes for about forty-three years. The next is the Worden. It has one little fault. It is a little inclined to be tender for long shipment, but it has good bearing qualities and you cannot beat it for a table grape or even a wine grape. The next is the Niagara. Those three grapes are like Mr. Armstrong's three varieties of peaches. Those are the three commercial grapes. If we want a grape for an early grape take Moore's Early. I would not advise anyone to plant Moore's Early on light ground as it does not make enough wood. It is not as hardy as the Concord and the Worden, but it is a woolly grape, a black grape, and a good grape. Then I suppose we must get some red grapes in, and for a good red grape I take the Vergennes, for that is a grape that will grow in sand or clay. It is close-jointed. With the Concord there are as a rule two bunches to a bud, but with the Vergennes there are four or five, and then it has a tendency of throwing another little stem from that bud that will have two, and you will have from the Vergennes often six or seven buds. So you see the necessity of cutting them short, down to about six buds. If your vines are ten feet and have six buds and four arms, that is twenty-four buds, they will always ripen. I have seen people grow them off the same length of wood and twice the number of buds and it would be late in the fall before they would colour up. The next grape I take is the Agawam.

That is a grape which I think is better for clay. If you have it on light soil it is apt to give you too much wood. I confine myself to those six. If someone else were here they might pick the Delaware or the Salem, but those are the six grapes I would recommend. I believe up around Winona they grow the Lindley, but that grape does not fertilize very well unless you clip the tips when they are getting the blossom. That takes time and it is not always done.

Q.—What do you think of Campbell's Early?

MR. STEWART: I would not recommend it. I have not been successful with it.

Q.—For a green grape how about Moore's Diamond?

MR. STEWART: It is not as large as the Niagara and the tendrils do not give enough curl. You have to tie it up with a heavy string. If you don't you will have the vine break off. It will not sell with the Niagara.

Q.—What about the Wyoming Red?

MR. STEWART: Probably one year in three you get it to bear well. It grows too much wood, and you have to strip it off or it will smother out.

Q.—It does well in the Burlington district. It is double the size of the Delaware and as good quality.

MR. STEWART: I would rather grow the Delaware.

SMALL FRUITS.

W. T. MACOUN, DOMINION HORTICULTURIST, OTTAWA.

After a few words of introduction the speaker proceeded to deal with the different varieties of small fruits.

STRAWBERRIES.

During the last twenty-five years we have tested probably six hundred main varieties of strawberries. During that time we have had a great many sorts which appeared promising for a limited time and then they failed. I may say that during the past ten years of all the new varieties we have tested, we have not found a single one to take the place of the older varieties, not a single one. I will give you now the names of those which have succeeded best with us, and I will just add a word or two on each of them: Bederwood, Splendid, Warfield, Senator Dunlap, Williams, Sample, Buster, Parson's Beauty. Of these the varieties which seem to be succeeding, or which are suited best for a wide area, I would mention the Senator Dunlap and Parson's Beauty. I know in Southern Ontario you are growing the Williams. We have not found that very successful in Eastern Ontario, and while undoubtedly it is one of the best up here, I should not care to recommend it for general planting all over Ontario. The Senator Dunlap seems to be the most popular in Canada to-day. I have had the opportunity of travelling over Canada from the Atlantic to the Pacific and the Senator Dunlap seems to have been the most successful. It is the most popular variety in places where they are easily grown and where they are not so easily grown. It makes any number of runners and these runners protect the crowns of the plant, or at least the leaves protect the crowns, and this variety comes through the winter better on the whole than almost any other sort that is being grown.

Another reason is on account of making so many runners you are nearly always sure of a good stand of plants, which of course is very important. The Senator Dunlap also keeps its size well to the end of the season. It is a good color and a heavy producer. I should like to say the Parson's Beauty in Western Ontario compares favourably with the Williams. I believe in many cases it would yield better than the Williams. It is a handsomer berry and has not so many white tips, and I believe on the whole I would take that in place of the old variety.

MR. ONSLOW: How do those varieties mentioned compare with the Williams for shipping?

MR. MACOUN: I would consider the Parson's Beauty as good a shipper as the Williams.

MR. HAMILTON: The Williams is going out rapidly in Clarkson. The Glen Mary is now the standard crop.

MR. MACOUN: We have not found that to be a shapely berry. It is large but irregular and rough looking.

Q.—Is the Parson's Beauty the same as the Gibson?

MR. MACOUN: We have not found it the same.

Q.—What would be the distinguishing features?

MR. MACOUN: Well, with us the Gibson is a darker berry, and a better quality than the Parson's Beauty.

Q.—Is the Senator Dunlap not too dark a color?

MR. MACOUN: No, it is a lovely shade of red which makes it very attractive. I have never heard it suggested before that it was too dark in color.

Q.—Does the Parson's Beauty not do better on heavier soil than light?

MR. MACOUN: Yes.

A MEMBER: I would like to say a word about the Glen Mary. It will stand the drought. The Sample was found to be a little soft, but we found those the most popular. The Senator Dunlap is grown a great deal, but we find it is apt to grow pretty small towards the end of the season. It has a tendency to grow black, and makes them look worse in the box than they really are.

MR. MACOUN: The point about the drought is a very important one. Strawberries vary more in different kinds of soil, I think, than any other kind of fruit. Some varieties cannot stand drought at all, while others stand it very well. Some do better on light soil, and some on heavy soil. The reason is they have entirely different root systems. Some have quite deep root systems while others have shallow root systems. The result is those which have shallow root systems suffer severely in the spell of hot dry weather. One cannot say really as definitely as one would like what variety of strawberry a person should grow.

GOOSEBERRIES.

Q.—What variety would you advise in gooseberries?

MR. MACOUN: I think perhaps the Whitesmith is the best variety of English gooseberry. We have not been successful in field culture in growing the English gooseberries. I would like to hear from anybody who has been spraying with lime sulphur, whether that continues a good remedy for gooseberry mildew. We have been spraying for some seasons but we find it is not entirely effective for gooseberry mildew on the English varieties.

MR. HAMILTON: I have not had any mildew on English gooseberries since I took to spraying with lime-sulphur. It is practically annihilated.

A MEMBER: I used it for five or six years and found it perfect.

Mr. Macoun: The American gooseberry is a productive fruit and averages a good crop if well cared for. It is, however, very important to have good foliage to protect the fruit from the sun, and unfortunately many let the currant worm destroy a large proportion of the foliage, and if the weather is hot the fruit suffers. Six bushes of Pearl gooseberry have averaged in five years at the rate of 12,402 lbs. per acre per year, or at 40 lbs. to the bushel, over 310 bushels per acre. The highest individual yield was in 1905, when five bushes of Pearl, six by four feet apart, yielded 75 lbs., or at the rate of 27,225 lbs. per acre, equal to over 680 bushels per acre.

The highest yield mentioned by Card in his work on Bush Fruits is at the rate of 450 bushels per acre, obtained at the Geneva Experiment Station, N.Y. He gives the probable range from 300 to 500 bushels per acre. Bailey gives the average as 100 bushels per acre, but we believe this is much below what is grown in Canada.

I would recommend the following varieties:

American.—Pearl, Downing, Red Jacket (Josselyn).

English (from experience at the Central Experimental Farm).—Companion, Eagle, Glenton Green, Queen of Trumps, Snowball.

English varieties usually recommended.—Whitesmith, Industry.

Raspberries.

The crop of raspberries, like most other fruits, depends largely on climatic conditions, and even though the best variety is planted, if the season is unfavourable or the plantation has not been cared for properly, the yield will be much lessened. As a rule it will be found that the more the crop can be increased by special care the greater the profits will be, the extra labour and expense made being much more than repaid for by the increased crop and additional revenue. A crop of raspberries, according to Bailey, ranges from 50 to 100 bushels per acre. Card found that the average yield of red raspberries estimated from the information received from 56 growers is about 69 bushels per acre. At the Central Experimental Farm the average yield of the Herbert raspberry for two years on one row 90 feet in length was at the rate of more than 205 bushels per acre, or about 6,586 lbs. From two rows, each 18 feet in length, or one row 36 feet long, the average yield for three years was over 229 bushels per acre, or 7,357 lbs. The average yield of the Brighton from two rows each 18 feet in length was over 175 bushels per acre, or 5,602 lbs. The highest individual yield was obtained from the Herbert in 1904, which produced 50 lbs. 12 oz. of fruit from two rows each 18 feet in length, or one row 36 feet long, which is at the rate of 10,234 lbs. per acre, or 319 bushels 26 lbs., estimating a bushel at 32 lbs.

While these large yields are from small plots, they show the possibility of increasing the average yield throughout the country very much.

For general culture I would recommend:

Red, *Early.*—King, Brighton, Count Marlboro.

Main crop.—Cuthbert, Herbert.

Yellow.—Golden Queen.

Purple.—Columbian, Shaffer.

Blackcaps.—Hilborn, Older, Gregg, Smith Giant.

Black Currants.

The following are the best:

Saunders, Collins Prolific, Buddenborg', Victoria.

Of those not yet on the market which are considered equal to or better than those above, the following are the best:—

Kerry, Eclipse, Magnus, Clipper, Climax and Eagle, and the Success for an early variety where yield is not so important as size and quality.

Topsy is very handsome and of good size and good quality, and ripens evenly, but has not been quite as productive as some others. Boskoop Giant is promising.

Q.—Can you tell us anything about the Boskoop Giant?

Mr. Macoun: Yes, I consider that most promising. Our bushes are not old enough yet, and I don't know of any one with a plantation old enough to compare it with the older sorts. Taking the younger bushes of three or four years of age the Boskoop Giant is one of the most promising black currants introduced. It is a very fine quality.

Q.—Is it not a little soft?

Mr. Macoun: Yes, a little soft.

Red and White Currants.

Of these fruits the best are:

Red—For general culture.—Pomona, Victoria, Cumberland Red, Red Dutch, Greenfield, Rankins' Red, Red Grape.

Where bushes are protected with snow in winter, and for the milder districts.—Pomona, Victoria, Cumberland Red, Wilder, Cherry, Fay and Red Cross. Perfection is promising.

White.—White Cherry, Large White, White Grape.

It is possible that under different conditions of soil and climate other varieties might do equally well.

Blackberries.

The blackberry is a more uncertain cropper than the currant, gooseberry and raspberry, as it suffers more in winter and is affected more by dry weather in summer. No really good crops of blackberries have been produced at Ottawa, the best yield being in 1895, when the Agawam yielded at the rate of 2,452 boxes per acre. The next best yield was in 1903, when the Agawam yielded at the rate of 1,979 boxes per acre.

Bailey, in his Horticulturist's Rule Book, gives the yield at from 50 to 100 bushels per acre, which at 32 lbs. to a bushel is from 1,600 to 3,200 lbs.

Those varieties most recommended for the fruit districts are:

Agawam, Snyder, Eldorado; and for southern section, Kittatinny.

THE USE OF FERTILIZATION IN APPLE ORCHARDS.

Dr. J. P. Stewart, Experimental Pomologist, State College, Pa.

The proper fertilization of an orchard is largely a local problem. It is no less a problem, however, because it is local. The same is true, to a marked extent, of many other orchard operations, not excepting cultural methods. It is true that of

late it has become a fashion among horticulturists to assume that the whole truth is known about cultural methods, that there is but one proper method for orchards and that all growers who do not follow it are either shiftless or ignorant. But the fact is, that even with cultural methods, the practice found best for one particular soil or location, or for one age of orchard or fruit effect, is by no means certain to be best for all others or even the best for the adjacent farm. In general, therefore, it appears that there are, at the present time, comparatively few horticultural principles or practices which are really exact or general in their application. Most of them seem to be quite subject to important exceptions, and hence usually they require some local modification or adjustment, if the best results are to be secured.

So it is with orchard fertilization. We know that it is likely to be important and we can now give approximate general directions for it. But when we come to the actual fertilization of a particular orchard, some local tests and local adjustments are usually desirable.

The Amounts of Plant Food Actually Taken Up by a Mature Orchard.

That there is an important need for fertility in any orchard that is actively producing and growing, there can be no reasonable doubt. The actual extent of this need can be approximated chemically by determining the average composition of apple wood, leaves, and fruit, and applying these figures to what may be considered good annual amounts of these products. This we have done both for apples and for a 25-bushel crop of wheat, with the results shown in Table I. The annual weights for apples are based on a yearly production of 100 pounds each of wood and leaves and 14 bushels of apples per mature tree. All these amounts are distinctly less than those actually observed and reported, but inasmuch as they give an annual yield of 490 bushels per acre of 35 trees, they are considered sufficient for the present purpose.

Table I.—Relative Plant-Food Draft of Wheat and Apples.

(In pounds per acre annually, based on American and German averages.)

——	Wheat Grain.	Wheat Total.	Wood.	Lvs.	Fruit.	Apple Total.
	lb.	lb.	lb.	lb.	lb.	lb.
Annual weights	1,500	4,200	3,500	3,500	24,500	31,500
Nitrogen (N)	30.0	43.7	11.3	25.6	16.2	53.1
Phos. acid (P_2O_5)	10.0	15.8	3.6	5.3	6.4	15.3
Potash (K_2O)	9.8	26.8	6.6	15.9	41.5	64.0
Lime (C_aO)	0.84	8.0	29.1	29.5	3.0	61.6
Magnesia (M_gO)	3.0	6.1	4.4	8.9	3.4	16.7
Iron (F_eO)	.....	.....	0.5	1.5	0.8	2.8

In the first place it will be noted that in total food draft the apples exceed the 25-bushel wheat crop in every constituent except phosphoric acid, and in it they fall behind only by half of a pound. Notwithstanding this fact the trees are usually able to maintain themselves much better and longer than wheat. This is probably largely because of their much longer season of root-activity, their more natural demands,* the annual return of most of the plant food in their leaves, and their

*This is especially marked in the case of the fruit as compared with the demands of the grain in wheat. For further discussion, see article by the writer in the Annual Report of the Pennsylvania State College for 1910-11, pages 447 to 449.

ability to curtail production for one or more seasons when conditions become unfavorable. Without going into details, however, it is quite evident that very important amounts of plant food are annually removed by an apple orchard. Scarcely any soil can furnish all these materials indefinitely in the amounts and times required, and unless proper assistance is rendered, there must come a time when production is materially reduced and off-seasons occur.

It is also interesting to note the relatively large amounts of nitrogen, potash, and lime, and the comparatively small amount of iron annually taken up by the apples. Nearly all the lime remains in the wood and leaves, while a larger proportion of potash is found in the fruit.

This large amount of lime seems to have some significance, so far as the wood is concerned, because, as shown later, in most of our experiments, its application has improved the growth. In view of the small amount of lime required by the fruit, however, its application should not be expected to materially affect the yields, and this corresponds with our field results. Moreover, the total effect of adding lime alone is surprisingly small, in comparison with the relatively large amounts that are taken up. Either these amounts are merely drawn in and deposited mechanically by the transpiration stream, and hence are largely without physiological significance, or else the average soil is still able to supply the lime needed.

With iron the case is very similar. This element is almost universally present in agricultural soils and the total amount required is so small that its addition can scarcely be expected to produce any important effect. This also is borne out by such experimental results as are now available.

From the large amount of potash carried by the fruit, one might suppose that its addition to the soil would be very important in improving yields, and this idea has been widely proclaimed, especially by those considering only the chemical composition of the fruit. As indicated later, however, it seems that most orchard soils are already sufficiently supplied with potash in available forms, and that the chief shortages occur in the nitrogen and phosphates. This is the case notwithstanding the fact that the latter materials are actually required in considerably smaller amounts.

From these facts it is evident that there is comparatively little relation between response and requirements in the case of plant food and that something more than knowledge of the chemical composition of the fruit and wood is needed before one can properly fertilize an orchard. Even with the additional knowledge of the composition of the soil, the problem is not much simplified, because it is impossible as yet to duplicate sufficiently the conditions existing in any soil.

A chemist may determine the total amount of plant food present, but he can not yet determine their actual availability to the trees with sufficient accuracy to be of much value. The practical and proper fertilization of an orchard, therefore, becomes an experimental problem, and its solution is dependent primarily upon the pomologist or horticulturist. In other words, the question is not so much what amounts of plant food are annually taken up, nor what amounts are present, but rather it is what responses are made when certain kinds and quantities of plant food are actually added to an orchard soil.

It is to get light on the latter question in connection with ten different types of soil that we have been working at the Pennsylvania Station since 1907. Altogether in the case of apples we have ten experiments on bearing trees and two on young trees, involving a total of more than 2,800 trees located in different parts of the

state, all of which bear more or less directly upon the present question. For the present, however, we shall call special attention to but three of these experiments, since they bring out most clearly the principal points involved.

Effects of Plant Food Additions to Orchards.

Some of the effects of adding plant food to orchards are shown in Table II. This table gives the yields obtained during the past five years in a 10-plot experiment with Baldwins, now 24 years of age, located on a Volusia silt loam in Lawrence County, north of Pittsburgh. In estimating the influence of the treatments the yields of the first year are excluded because they can never be materially affected by the applications of the first season. The yields are given in pounds and also in bushels per acre annually for the last four years.

Table II.—Influence of Fertilization on Yield (Johnson Orchard).

(Yields in pounds and bushels per acre, 1908-1912.)

Plot	1	2	3	4	5	6	7	8	9	10
	Check.	Nit. and Phos.	Nit. and Potash.	Check.	Phos. and Potash.	Comp. Fertilizer,	Check.	Manure.	Lime.	Check.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1908	90	528	237	446	57½	759	211	278	558	106
1909	675	6,018	5,257	1,932	3,089	6,621	2,008	3,531	1,216	1,266
1910	2,575	3,265	1,622	3,168	3,552	2,108	1,629	6,149	3,185	3,505
1911	283	7,563	7,816	617	1,227	8,209	1,362	4,874	388	106
1912	1,024	1,225	696	1,382	1,385	189	1,226	6,698	741	474
Total four years	4,557	18,071	15,591	7,099	9,253	17,127	6,225	21,252	5,530	5,351
Bushels per acre annually	136.7	542.1	467.7	213	277.6	513.8	186.7	637.5	165.9	160.5
Annual gain over check, Bushels per annum	*.....	377.9	293.5	.....	103.4	339.6	.....	463.3	—8.3	.....

In the first place, it will be noted that the checks, or unfertilized plots, have run fairly uniform, producing an average annual yield of 174.2 bushels per acre during the last four years. Lime alone (at the rate of 1,000 pounds per acre annually) has shown no improvement over the average check, and as a matter of fact it has averaged 8.3 bushels per acre less, a deficit that is doubtless largely or wholly due to incidental causes and natural fluctuations. The phosphate and potash combination has affected the yield here rather distinctly. This may be at least partly due to a possible advantage in the location, as indicated by the fact that its adjacent check is the highest producer among them and is averaging within 64 bushels of the phosphate-potash treatment. The growth on the latter plot, however, is nearly 3 per cent. less than the normal unfertilized plot, and its general appearance is not appreciably superior to that of the checks. It is evident, however, that these trees are still vitally in need of something, although it should be noted that they are receiving the fertilization commonly advised for orchards, largely on the basis of chemical analysis.

This need is being quite thoroughly met on the adjacent Plot 6, which differs from number 5 only in the addition of nitrogen. The mere addition of nitrogen

*The average check or unfertilized plot produced 174.2 bushels per acre annually during 1909-1912.

in this case has more than tripled the gain. Wherever nitrogen appears in the treatments very large yields are observed, and the foliage and growth of the trees are very satisfactory, the average gains in trunk-girth ranging from 25 to 90 per cent.

Plot 2, receiving nitrogen and phosphate only, at the present time shows a better gain than number 6, which receives potash in addition. This is directly connected with the almost complete crop-failure that occurred in the latter plot this past season, and it is also doubtless partly attributable again to natural fluctuations in yield. It shows, however, that no additional potash is needed in this orchard, so far as yields are concerned.

Phosphates are next in importance to nitrogen here, as indicated by the 42-bushel average deficit that occurs on plot 3 as compared with number 6, when phosphorus is omitted in the former, and also by the high yields on plot 2. Manure, as a result of the extra large crop of 1912 when most of the other plots were having an off-season, is now in the lead in this experiment, with the tremendous average yield of 637 bushels per acre annually for the past four years. This gives an annual gain over the check of 463 bushels per acre, which is a very satisfactory exchange for 12 tons of manure. This benefit from manure is doubtless largely due to its nitrogen content, the proof of which becomes more evident later.

Time Required for Results to Appear. It is a common impression that long times are required to determine the value and kind of fertilizer needed for an orchard. It will be noted here and in the following experiment, however, that both these facts were thoroughly evident in the season immediately following the one in which the fertilizers were first supplied. In other words, both the value of fertilization and the kind of fertilizer needed were clearly evident in these two cases within a single year after the first application, and the conclusions formulated then have not been materially changed by the results of the four or five additional years that we now have. In most other cases, also, where these facts did not appear in the first two or three seasons of bearing they have not appeared in the five or six years now available. This is of special importance in connection with the local tests recommended later, though in them we advise at least three years of trial, for the sake of a wider margin of safety and greater stability in the resulting conclusions.

Results from the Brown Orchard.

This experiment is located in Bedford County on De Kalb stony loam—a residual, foot-hill soil chiefly of sandstone origin, which is commonly used for orchard purposes. The trees in this case are York Imperial, now 24 years old. It involves the same treatments as those in the Johnston orchard and four others besides —those in plots 6, 9, 11, and 12. It also was started a year earlier, in 1907, and the results of that season are excluded in the present table for reasons stated above.

TABLE III.—INFLUENCE OF FERTILIZERS ON YIELD (BROWN ORCHARD).

(Yields in pounds per plot, 1908-1912.)

Plot Treatment.	1908	1909	1910	1911	1912	Totals.	Benefit over Normal.	Annual Gain over Average Check.*
						lb.	%	Bu. per A.
1 Check	2,402	25	4,052	1,588	453	8,520	.....	.....
2 Nitr. and Phosphate	4,153	588	5,920	2,219	7,281	20,161	204.8	376.5
3 Nitr. and Potash	3,079	78	3,838	1,567	5,402	13,964	196.6	259.2
4 Check	754	9	470	1,260	309	2,802	.....	.....
5 Phosphate and Muriate	1,014	252	2,381	1,643	616	5,906	79.9	75.2
6 Phosphate and Sulphate	292	266	1,368	1,299	356	3,581	—4.8	10.1
7 Check	254	192	1,115	1,568	1,117	4,246	.....	.....
8 Nitr. Ph. and Potash	1,219	454	2,436	3,241	4,931	12,281	208.7	253.7
9 Nitrogen	863	1,575	120	3,082	1,614	7,254	96.—	113.0
10 Check	458	515	787	1,448	222	3,430	.....	.....
11 Acid Phosphate	104	892	787	794	64	2,641	—25.9	—16.2
12 Raw Phosphate	100	124	581	703	123	1,631	—55.9	—35.5
13 Check	266	257	2,096	498	727	3,844	.....	.....
14 Manure	621	1,947	778	7,334	1,117	11,797	273.9	240.2
15 Lime	152	160	1,029	1,060	288	2,689	9.0	—14.8
16 Check	246	36	943	387	166	1,778	.....	.....

In general we have the same types of results here as in the preceding experiment—large gains from nitrogen, phosphates and manures, with relatively small effects from potash, and again no advantage at all from lime. There are greater irregularities in this experiment, owing somewhat to its greater size, but chiefly due to the presence of a wood on the mountain side above the first check plot, from which the latter is separated by a single row of trees. The leachings from the floor of that wood have acted much like a nitrogenous fertilizer, and as a result the trees nearest the woods, although of the same age as those farther down, are considerably larger, thus accounting for the greater yields of the first two or three plots. This influence practically disappears, however, before the fourth plot is reached, as shown by its low yields—those of a typical check.

The differences observed in the last two columns are due partly to these irregularities, partly to a certain amount of leaching and cross-feeding on the part of some of the checks in spite of separation rows below each treated plot, and partly to a different method of calculation. In one column the benefit is figured on the basis of the normal production of the immediate plot concerned, which method is supposed to eliminate soil irregularities to the greatest possible extent. When the adjacent checks are being benefited by leachings or cross-feeding, however, this method fails to show the full benefit due to the treatment. This failure is especially evident in plot 6, which shows an apparent negative influence in the "normal" column and a positive influence of ten bushels per acre annually in the column based on the average check. The apparent negative influence is due directly to extra yields in the adjacent check, plot 7, which is apparently receiving some benefit from plot 8 as a result of cross-feeding. The same thing appears in the negative figures shown by Plots 11 and 12, though they are not entirely eliminated by using the average check as the basis. The average check, moreover, is not entirely free from the cross-feeding influences, since it only distributed the extra yields, and hence it is probable that

*The annual gains over their "normal production" are indicated in plots 2 and 3. Their annual yields were 564.5 and 391 bushels per acre respectively. The average check, omitting No. 1, was 3,220 lbs. per plot, or 90.16 bu. per acre annually.

the negative figures in plots 11, 12, and 15 of the last column merely indicate that these materials have no definite influence when applied by themselves, and the further deficits are attributable simply to natural fluctuations.

Returning now to the results themselves, and especially to those treatments not included in the preceding experiments, we may note first that muriate of potash in plot 5 has given much better gains than the sulphate in the adjacent plots. This is contrary to the results of the Massachusetts experiment, but similar results are now being shown in all of our own experiments wherever the comparison occurs. Hence the differences in the Massachusetts experiment would seem to be due to something other than the difference in potash carriers. At present, therefore, we believe that the muriate is at least as efficient as the sulphate, and in view of the facts that it is cheaper, more soluble, and much less subject to "caking" in the mixtures, we are now using and recommending it for apples.

In plots 11 and 12, and other similarly treated plots in our experiments, we see the apparent futility of attempting to materially improve yields by applying phosphates alone. This is not due to the fact that phosphates are not needed, nor can it be largely attributable to the absence of cultivation, as may be seen by comparing the results in plots 9 and 2. Nitrogen by itself, in No. 9 shows an annual gain of 96 per cent., or 113 bushels per acre, but when phosphorus is added in plot 2, these benefits are more than doubled. Phosphorus as usual, therefore, appears to be the next in importance after nitrogen in improving yields.

The Permanence of Fertilizer Influence: It is another fairly common impression that the influence of fertilizers is transient, and that, even where there effect is favorable at first, this effect soon wears out and may leave the soil worse than before. This evidently depends very largely on the character of the fertilization, and in this respect apples are not different from other crops. If the gains are induced by some caustic action of such materials as gypsum or lime when used alone, this may actually be the final result.

On the other hand, it should be noted here that in plots 2 and 3 and 8, where definite plant foods are being supplied, the effects of fertilization were greater than ever before in 1912, the sixth year of the experiment. The steadiness and regularity of the increases also are especially notable in plot 8, which shows a distinct gain in every year except 1909, and in that year the yield would have been fully 1000 lb. greater had there been sufficient moisture available to properly develop the fruits that were actually present.

In plots 2 and 3, the fertilization has not been complete and also the yields have been so large in the even-numbered years that it was impossible to prevent some alternation with lighter crops in the odd years. This same general condition is evident to a considerable extent in the Johnston orchard. In other experiments, however, and especially in one primarily on cultural methods in the Fasset orchard, with proper fertilization and with crops ranging between 300 and 600 bushels per acre, we have steady increases on Baldwins and Spies similar to those in plot 8, which extended over a period of five years before any increase appeared.

The unusual size of the 1912 crops on plots 2 and 3 in the Brown experiment should also be noted. While their adjacent checks, 1 and 4, were showing an average yield of 73.2 bushels per acre, plots 2 and 3 were producing the tremendous average of 1,217.5 bushels per acre, and 1,006 bushels of this were picked fruit. The terminal twig-growth of the checks, also, would scacrely average half an inch for the season, while that of the fertilizer plots, in spite of their enormous crops, averaged from 6 to 8 inches, with frequent terminals running up to 2 feet.

And all these differences were brought about solely as a result of differences in fertilization. The spraying, pruning, soil management, variety and age of trees, and all other visible features were just the same on the checks as on the fertilized plots.

Results in the Tyson Orchard.

In the two preceding experiments, we have seen very large annual gains resulting from certain fertilization, particularly that rich in nitrogen and phosphorus, regardless of whether these elements were carried in manure or in commercial forms. In these cases, also, the gains from potash were relatively small or entirely absent. Thus far in the Tyson experiment, so far as yields are concerned, we have practically the reverse conditions.

The trees in the latter experiment are much younger, being now but fourteen years of age. The varieties are York Imperial and Stayman Winesap, the latter having being top-worked on certain York rows about six years after planting. The soil is a relatively heavy silt loam, and tillage and annual cover crops have been maintained near the trees practically uniformly since the orchard was started. The annual growth and general appearance of all the trees in this experiment are much better than those of the average check trees in the two preceding experiments. Practically no fruit had been borne by these trees, when our experiment was started in 1907, and there has been but one fairly full crop since then—that of 1911. The treatments are the same in the Brown experiment and the results are shown in Table IV.

Table IV.—Influence of Fertilization on Yield and Growth in Experiment 215 (Tyson Orchard.)

(Yields in pounds per plot, 1908-1912.)

Plot Treatment.	1908	1909	1910	1911	1912	Totals	Benefit over Normal.	3 Year Annual Gain over average Check.	Growth Gain over Normal 6 year.
							%	bu. per acre.	%
1 Check	14	95	346	2,053	549	3,057	.....	.....	.....
2 Nitr. and Phos.	26	73	301	2,277	464	3,141	8.0	12.2	7.4
3 Nitr. and Potash	43	115	418	3,043	542	4,161	50.9	43.0	17.7
4 Check	21	54	260	1,555	719	2,609	.....	.....	.....
5 Phos, and Mur.	26	146	476	2,828	495	3,971	46.1	36.5	8.1
6 Phos. and Sulf.	61	179	483	2,352	975	4,050	43.2	36.8	2.3
7 Check	18	45	235	1,777	862	2,937	.....	.....	.....
8 Comp. Fertilizer	21	74	300	2,885	190	3,470	26.7	22.9	12.7
9 Nitrogen	17	83	229	1,746	551	2,626	3.5	—4.7	7.9
10 Check [1]	17	89	150	1,579	504	2,339	.....	.....	.....
11 Acid Phos.	3	43	153	1,359	655	2,213	—9.8	—15.8	4.4
12 Raw Phos.	4	62	164	2,010	842	3,082	20.0	11.4	0.8
13 Check	31	46	103	1,886	615	2,681	.....	.....	.....
14 Manure	15	52	190	2,333	262	2,852	4.1	4.—	14.6
15 Lime (and Fertilizer)	27	86	186	1,765	1,113	3,177	13.4	13.1	—1.6
16 Check	10	76	115	1,922	739	2,862	.....	.....	.....

As already indicated, the relative youth of these trees makes both their yields and differences much less than those in the preceding experiments. With increasing age, it is probable that some of the results may be different, especially in view of the relative growth that is now being made under the different treatments. At present, however, certain facts are of interest.

In the first place, the practical failure here of both manure and nitrogen is quite remarkable. The regular annual application of 12 tons of stable manure, in this case, has resulted in an annual gain of less than four bushels of apples per acre. During the same time, nitrogen alone has shown no gain at all, and nitrogen and phosphates, which were so effective in the preceding experiments, here show annual gain of only 12 bushels per acre—not enough to pay for the treatment.

Potash, on the other hand, in direct contrast to its effect in the experiments above, here shows a distinct gain in yield wherever it is applied. The best of these gains—in combination with nitrogen—is only 43 bushels per acre annually, but this is more than a 50 per cent. increase over the normal yield, and it shows a fair profit over the cost of treatment, besides giving over 17 per cent. of an increase in growth. Potash applications, therefore, have evidently been of value in this orchard, even when those of manure and of nitrogen and phosphates were largely failing.

The Action of Manure *vs.* That of Commercial Fertilizers.

The above facts, taken in connection with those shown in the two earlier experiments, indicate that the plant-food action of manure is practically identical with that of a commercial fertilizer rich in nitrogen and phosphates. It also apparently indicates that the potash in the manure may be less readily available than that carried in commercial forms. The old controversy over the relative value of manure and commercial fertilizers, therefore, is without any particular significance so far as plant food is concerned. Either type of fertilizer may be successful or either may be a failure, depending upon the particular conditions involved.

The manure, however, often has some additional value, due to its mulching effect. This, of course, cannot be duplicated by commercial fertilizers alone, though it may be duplicated by any other kind of a mulch, as has been shown especially in our experiment 339 in Bradford County. The matter of availability also must often be considered, and it is for this reason that the relation between manure and nitrogenous fertilizers should be well understood. Besides this, it sometimes happens that large and regular applications of manure result in a distinct increase in the amount of blight, and also in an undue increase in the size of the fruit and in the amount of punky pitting in the latter. In such cases, a reduction in the applications, or the partial or the complete substitution of a proper commercial fertilizer is desirable.

A Summary of Fertilizer Influences on Apples.

It is impossible in the present space to consider all our experiments singly, to the extent done with the three just considered. Before passing to the last stage of our discussion, however, it seems desirable to present a very brief tabular summary of the fertilizer influences shown in six of these experiments, including the three just considered. This summary shows the calculated influences of the various fertilizer elements on four important characteristics of apples, viz., their yield, color, average size, and the amount of wood growth. The relative values of the different elements during a five-year period, in terms of per cent. of benefit over the normal results obtained without fertilization, are shown in Table V.

TABLE V.—INFLUENCE OF FERTILIZER ELEMENTS ON APPLES.

(Average benefits over normals, 1908 to 1912.)

——	Yield.	Colour.	Size.	Growth.
(a) Experiments 215, 216 and 220:	%	%	%	%
Nitrates in combination	62.7	—11.0	—0.7	10.43
Nitrates alone	32.5	—12.7	—4.3	15.51
Phosphates in combination	20.2	— 2.1	0.3	2.28
Phosphates alone	—10.7	2.7	—0.6	2.45
Potash in combination	15.1	2.7	5.8	3.67
Complete fertilizer	78.3	—15.4	5.2	17.67
Manure	75.9	—11.4	5.8	29.07
Lime alone	— 8.24	— 0.3	—2.0	6.31
(b) Experiments 336, 338 and 339:	1908–12	1909–12	1909–12	1908–12
Nitrates in combination	74.5	—12.7	—0.4	27.00
Phosphates in combination	33.5	— 2.8	4.9	—0.23
Potash in combination	— 3.6	1.4	7.1	2.79
Complete fertilizer	80.5	—15.6	5.2	29.63
Manure	168.8	—15.9	25.2	37.34
Lime alone	29.8	— 5.4	15.9	15.48

Without going into details it may be noted that in general the same influences that have materially increased the yields have also increased the growth. In other words, our best growing plots have as a rule been our best fruiting plots. On sound, healthy trees, this will generally be the case unless either occurs to an abnormal extent, in which case the other may be somewhat reduced. Mild injuries may also stimulate yields at the expense of growth.

In Table V., the most marked exception to our rule above appears in the case of the phosphates, especially in the lower section of the table. This may be connected with the fact that the old wood especially is very low in phosphoric acid, as shown in Table I., and our present definite growth determinations are based upon increase in trunk-girth alone. On twig-growth, however, our observations indicate that phosphate additions have been very helpful, particularly in the Brown orchard. This also tends to bring it in line with our rule above.

THE CONTROL OF AVERAGE SIZE. So far as fertilization is concerned, manure and potash are the only materials that have consistently benefited size. The manure influence is doubtless very largely due to its mulching or moisture conserving effect, since moisture makes up about 84.6 per cent. of this fruit on the average,* The potash influence, also, so far as it is a definite benefit, is probably brought about through the same medium, inasmuch as potash is credited with some ability to increase the osmotic power of the cells, thus enabling them to compete more successfully for whatever water is present.

There is also a distinct possibility that the apparent benefit of potash on size may be largely due to the fact that it is associated with much lower yields than the other materials, especially nitrogen. Conversely, their failures to increase size may likewise be due to their association with markedly increased yields.

This brings out the general proposition to which we have called definite attention elsewhere, that with a normal moisture supply the dominant influence controlling size in apples is the number of fruits on the tree, after this number has passed a certain optimum or "critical point." This point, however, is relatively

*See Table XVIII. in the writer's article in the Annual Report of the Pennsylvania State College for 1910-1911, page 435.

high, our data showing that even on trees up to 15 years of age, little or no correlation appeared until the number of fruits had reached 1,400 or more per tree. Above this point proper thinning is the most important means of increasing the size of the fruit. Below it, the size can usually be markedly affected by moisture supply, cultural methods, manure, and possibly by fertilizers—especially those rich in potash. The latter factors may also co-operate in such a way as to materially raise the critical point. In general, however, proper thinning and moisture conservation are the most important means of improving fruit size.

The Control of Fruit Color. In Table V., it will be observed that none of the fertilizer treatments have resulted in any marked improvement in color. Slight and irregular benefits are shown by potash and some of the phosphate applications, but nothing of any importance. The same is true of iron applications so far as experimental evidence is concerned.

These facts again lead up to the general propositions that color in apples can not be materially increased by fertilizer applications, and that the red colors of apples are essentially dependent upon maturity and sunlight. Conditions that tend to increase one or both of the latter factors, such as late picking, open pruning, light soils, and sod culture, tend to increase the red color. Opposite conditions decrease it.

These propositions make it clear why the nitrates and manure apparently injure color. It is simply done by retarding maturity and diminishing the available sunlight as a result of the increased density of foliage. To determine the truth of this, in 1911 we left the fruit on the nitrate plots in the Johnston orchard, until it had reached approximately the same degree of maturity as that attained by the checks when their fruit had to be picked on account of dropping. The delay required was fully three weeks—from September 29th to October 19th—and even then the later fruit picked much harder than that on the checks, besides showing a much lower percentage of drops. The amount of color on the nitrate plots at the later date was actually greater by 10 per cent. than that shown on the checks at their picking time.

The occasional marked increase on color as a result of spraying is largely explainable on similar grounds. The sprays reduce the worminess and thus enable the fruit to remain longer on the tree. It also may reduce somewhat the amount of foliage as a result of spray injury, thus permitting more light to reach the fruit. In general, however, in improving color, chief reliance must be placed on those methods that tend definitely to secure fuller maturity on the trees and to get the maximum amounts of light to the fruit.

Applying Present Data to Individual Orchards.

In the three experiments discussed separately above, it was noted that the materials found most valuable in the first two were failures in the third, and *vice versa*. In still others we might show cases where no form of fertilization has yet shown a profit. These and other cases prove conclusively the local nature of the problem. Hence not even the experiments of others can offer more than general advice on the fertilization of a particular orchard.

This advice can doubtless be made more exact after a personal examination of the orchard concerned, by one who is familiar with orchard fertilization work, or it may be done with greater certainty if the owner will give attention to some of the more important characteristics of orchards needing fertilization. The latter are best observed in late summer and fall.

In general, the characteristics of the orchard that is certainly in need of a fertilizer are those of starvation. They are usually sufficiently familiar to need no extended description. They are found most commonly in the older orchards that have once borne well, but no longer are doing so, though still fairly free from important diseases or improper drainage. The foliage is sparse and pale in such orchards, and the annual growth stops early and averages short—often no more than a half inch, and from this it may range up to two or three inches. In each cases, one can usually apply fertilizers fairly liberally with practical confidence of profits, providing the varieties and other handling are right. Even in such an orchard, however, it is advisable *to leave a small typical portion unfertilized* to really determine the value of the treatment.

Under opposite conditions, such as obtain in most young orchards, or in any orchard that is still growing and fruiting well and retaining its foliage until late in the season, fertilization is much less likely to show a profit. Even in such cases, however, there is often enough probability of benefit *to warrant some trial of fertilization, but only over a relatively small area,* and with most of the orchard left unfertilized as a check.

These trials are especially necessary in the intermediate orchards—those on the zone line between the two extreme types just described. Occasionally this intermediate type of orchard will respond very strongly to fertilization without necessarily showing the characteristic marks, as is essentially illustrated in the Johnston orchard.

A General Fertilizer Recommendation for Apples.

For preliminary use in such cases and for permanent use on the part of those who are unable to carry out such a local test as is shown later, we are now recommending the general fertilizer indicated in Table VI. The fertilizers are stated in amounts per acre rather than in amounts per tree, because of the varying numbers of trees that are planted on an acre. The amounts per tree for any particular case are readily obtainable, however, by dividing the present amounts by the given number of trees per acre. With young trees the amounts may be reduced approximately in proportion to the area covered, making this area correspond with that of the roots so far as possible.

Table VI.—A General Fertilizer for Apple Orchards.

(Amounts per acre for bearing trees.)

Nitrogen. 30 lb. (N.)	Phosphoric acid. 50 lb. (P_2O_5)	Potash. 25 to 50 lb. (K_2O)
Carried in: 100 lb. Nitrate and 150 " D. Blood, or in 150 lb. Ammon. Sulphate.	Carried in: 350 lb. Acid Phosphate, or in 200 lb. Bone Meal, or in 300 lb. Basic Slag.	Carried in; 50 to 100 lb. Muriate, or in 100 to 200 lb. low-grade Sulphate

For young orchards, reduce these amounts in proportion to area covered.

This table means that a fertilizer carrying about 30 pounds of actual nitrogen, 50 pounds of actual phosphoric acid (P_2O_5), and 25 to 50 pounds of actual potash (K_2O) should be applied on an acre of bearing trees. Where potash is not known to be lacking the smaller amount may be used, or after a little testing it may be even omitted entirely. With the smaller amount of potash, the essentials of the present combination are carried in 500 pounds of a 6-10-5 fertilizer or its equivalent. In the usual ready-mixed fertilizers the nitrogen is likely to be carried in ammonium sulphate, with which some liming may be necessary if many applications are made, and especially if leguminous cover crops or permanent covers are desired. In special or in home-made mixtures the various elements may be carried in any of the materials indicated on the table.

In our work the nitrogen is carried in the combination of nitrate of soda and dried blood indicated in the table. This combination carries about equal amounts of nitrogen in each material, and it thus gives a quick action as well as one that is prolonged well through the season. The nitrogen, being the costliest and most active ingredient, requires close watching and possible variations in amount in order to get the most out of it. It may also be secured, wholly or in part, by the use of stable manure or leguminous plants where they are available. With the other carriers indicated in the table we have very little evidence on their relative values as yet, and hence those that are actually least expensive or most convenient should be chosen. All applications should be made annually, subject to the variations indicated below.

Time and Method of Application.

The time of application we believe to be of distinct importance, especially in the case of nitrates. While our evidence on this is by no means complete, yet there are good indications that nitrates can easily be applied too early in the season and thus be wholly lost to the trees. Other evidence leads to the opinion that distinct harm may result from their application about fruit-setting time, especially in the case of the peach. We feel, therefore, that the nitrates should be applied not earlier than petal-fall in apples and probably not later than the middle of July. In general, about the middle of this period should be very good, though some of our most striking results have come from applications made as late as the 8th of July.

With the peach, in Missouri, Dr. Whitton reports that the time of application is very important and that very large increases in yield have been obtained from moderate quantities of nitrate of soda alone when "applied at the right time."* This is considered to be "after the main length-growth has taken place in early summer." Such applications kept the trees from going into the rest period too early, and maintained a green and healthy condition throughout late summer and autumn without renewing the growth in twig length. It may also be noted that in the English work, at the Woburn Experimental Fruit Farm, July applications proved beneficial, while those made in February were of no avail.

An incidental advantage of the delayed application appears in the fact that it gives an opportunity to vary its rate somewhat in accord with the size of the crop set on the trees. When the crop is light much smaller applications are required, because of the natural tendency of the trees to develop a sufficient number of fruit buds in the off season. Proper utilization of this fact should save much in a series of years and also enable one to secure the maximum return for the fertilization applied.

*See Proceedings of the Society for Horticultural Science, 1911, p. 37.

In the case of the mineral ingredients, with their lower solubility and slower action, the time of application is less important. Some of the most careful observers in commercial work regularly apply their phosphates and potash in the fall on their peach orchards, and believe that this gives best results. Thus far, however, we have felt that the time of application for the minerals is of relatively little importance since they are rather quickly fixed in the soil, in any case, and they do not leach readily. We, therefore, apply them along with the nitrogen at the time that we consider best for it.

The method of application that we have followed is merely to scatter the fertilizer or manure broadcast over the surface of the ground, taking care not to get it too close to the tree trunk, where there are few absorbent roots, and extending the applications well out beyond the spread of the branches. To conform more closely with the distribution of feeding roots, the rate of application is made heaviest in the central part of this area, or in general it is applied heaviest under the outer two-thirds of the spread of the branches. This fertilization may either be left on the surface to be washed in by the rains or it may be harrowed or lightly plowed into the soil. With all this done, it should be remembered that the fertilizer applied in any given season can hardly materially affect the yield of that year, since the fruit buds are formed in the latter part of the preceding season. Important results, therefore, should not be expected before the following season, at the earliest, and as indicated in some of our experiments, they may not appear until considerably later and still prove of value.

Determining the Actual Needs of an Orchard.

The general fertilizer formula indicated above is for use only until the exact needs of the particular orchard can be determined. In other words, it is intended only to meet the immediate demands. If, in the meantime, one wishes really to answer the question of how to fertilize his own orchard he can do so by following the plan outlined in Table VII. This plan is especially adapted to the needs of commercial orchardists and to "community" tests on the part of the smaller growers.

Table VII.—Plan for Local Orchard Fertilizer Test.

(Pounds for a mature tree in bearing.)

1. Check (Unfertilized).
2. Nitre, 2½ lb.; Dried Blood, 3½ lb.; Acid. Phos., 10 lb.
3. " 2½ "; " " 3½ "; Potash, 2 lb.
4. Acid Phosphate, 10 lb.; Potash, 2 lb.
5. Check.
6. Nitre, 2½ lb.; Dried Blood, 3½ lb.; Acid. Phos., 10 lb.; Potash, 2 lb,
7. Same as VI., plus Lime, 12 to 25 lb.
8. Manure, 400 lb.
9. Check.

This plan should be located in a typical part of the orchard, and should include not less than five average trees of the same variety and age, in each plot. All the trees should be labeled and carefully measured at a fixed point on the trunk, and definite records of their growth and yields should be kept for at least three years. Frequently good indications of the orchard's needs may be obtained in less time than this, as shown above in the Johnston and Brown orchards, but at least this amount of time should be allowed and more should be used when necessary.

The same time and methods of application and other precautions should be followed as described above. The materials are indicated here in amounts per

bearing tree instead of per acre as above and the same reductions should be made for younger trees. In other words, if only a third of the ground is to be covered, then only about a third of these amounts should be used, if the rate of application is to be kept within proper bounds.

These general precautions, together with the exercise of proper judgment on the part of the grower, are entirely sufficient to carry this plan to a successful conclusion and definitely settle the fertilizer needs of any ordinary orchard within a few years. If additional rules and precautions are desired, however, they can be found in the Annual Report of the Pennsylvania State College for 1910-11, pages 409-11. In addition, it should be remembered that an orchard may not show the need of a fertilizer when young, but may develop this need later, especially when heavy bearing is reached. This means that the cases that appear negative at any one time may often need further tests and attention later.

Q.—What would be the relative cost of manure?

PROF. STEWART: We put on twelve tons of manure to the acre, and we put on a commercial fertilizer in this experiment which would cost us about $15 to $18 per acre. I do not know what manure costs. It costs us anywhere from $1 to $3 or $4 per ton. It is such a variable thing. It is twelve tons, and that will give you the relative cost. However, the fertilizer that we are now recommending, based on the results of these experiments, can be made up for about $10 an acre, and if one can get his nitrogen by means of cover crops or possibly by alternating with manure he can reduce that to perhaps $4 an acre for the phosphoric acid and the potash.

Q.—Was there any cultivation?

PROF. STEWART: It was in a variety of conditions. It was without any cultivation whatever, the fertilizer being merely put on the surface of the ground and being washed in by the rain, and yet we got those gains. There was no cultivation uniformly throughout, however.

Q.—Was it sod?

PROF. STEWART: Yes, though it was not a particularly dense growth. There were Baldwins 24 years old, and they were practically occupying the ground.

Q.—When applying a large amount of nitrogen have you noticed any difference in the color of the fruit?

PROF. STEWART: As a general proposition if the fruit is picked early there is a marked reduction in the color, but if you let the fruit stay on the trees until it reaches the same state of maturity as occurs in the checks much before, you can get practically the same amount of color in nearly all varieties. We tested that matter thoroughly and we found that the retardation in maturity due to nitration was fully three weeks, and we found it had a higher color, actually an increase in color. So it is a question of the relative maturity. Nitration delays maturity and in that way it affects the color. It is not a question of being directly opposed to color, but it reduces color indirectly by retarding maturity, and if you pick it at the same time your nitrate fruit will be much greener than the other.

Q.—I notice in the manure the percentage or average is higher.

PROF. STEWART: I can explain that very easily. The percentage of benefits is figured on the normal production of the manure applied so and the normal production between this and the manure is based on the two adjacent checks. You will notice check "13" has only 3,800 pounds of fruit and check "16" has 1,700. They are relatively low checks, so that the normal production of this manure plot

we would figure would be relatively low, and consequently its actual production is based on that relatively low normal production. (Indicates on chart.)

Q.—You say that was a much younger orchard? Do you think that accounts for the results?

PROF. STEWART: Undoubtedly it has a bearing, but we have got other orchards that are younger that are responding pretty well, and other orchards that are older that are not responding as well, so that matter of age is another matter that has a bearing.

Q.—Is it possible by analyzing the soil to know what is the best fertilizer?

PROF. STEWART: Not very possible. You can get some idea. If there is something very deficient you can find it out by chemical analysis, but the way to get at it is to ask the trees.

Q.—Will this refer to stone fruits as well as apples, or is there a different requirement there?

PROF. STEWART: Really I am not prepared to answer that, because our experiments on peaches, which is the only stone fruit we are working on, have not gone far enough to afford a basis, and I do not like to answer things without any basis for it, because they generally come out wrong when you do. I will just hazard a guess. My opinion is this, that it makes more difference as to the kind of soil your peach orchard is grown on, and the previous treatment of that soil on the question of the value of fertilizer and the kind of fertilizer than the fact that it is a peach tree. The requirements of a peach tree and an apple tree are much more similar than the soil and previous treatment of soil are.

Q.—Would potash improve the color?

PROF. STEWART: It does not improve it. You have seen the color results from potash. It showed there was one-half per cent., or one-half of one per cent., less color on potash. The amount is so small that it is negligible, and it seems to indicate to me that potash has not affected it. If it was one or two per cent. above I would say that potash had not affected the color because the effect is too small not to charge up to accident.

Now, my net conclusion from these things which I have just gone over with you, and also from a study of all our other experiments, is that orchard fertilization is primarily a local question or local problem. However, do not get it into your minds that fertilization is not an important matter when it comes to fruit production. Our first chart shows that it is bound to be an important matter, and the next two charts show the field results prove it to be an extremely important matter, but it is a matter to be settled locally. People say they have not time to make these tests themselves, and so it is up to us as experimental station men to name your formulæ. The results I have given you are based on six years' work on this question.

Q.—What is a satisfactory growth?

PROF. STEWART: Of course that varies with the size of your tree and the number of limbs. I do not know.

Q.—In a young orchard with small trees?

PROF. STEWART: I do not know what a satisfactory growth would be. Three or four feet would be surely satisfactory in a young orchard.

Q.—It would depend a great deal on the variety?

PROF. STEWART: Yes, and the general situation.

Q.—You have not said anything about the use of cover crops?

PROF. STEWART: That will come up in connection with my address to-morrow.

My ideas on cover crops have suffered a shock in the last few years. However, I will tell you about that to-morrow.

Q.—How about the cover crop ripening up the wood for the winter?

PROF. STEWART: It will do that; but right along that line I might say that nitrogen will prolong the growth three or four weeks or a month. They seem to stand the winter without being wrapped up so early with us. It might not be so with you. I was surprised to find that nitrogen, which prolongs the growth so much, should not result in winter injured trees, but it has not.

Q.—What is the best cover crop you have tried?

PROF. STEWART: The cover crop that I think is best now is the hairy vetch, and then one or other of the clovers—crimson or red. It depends on your conditions. If the hairy vetch will come through the winter without winter killing to any great degree, I would certainly favor it in my orchard over anything else, because it is such an extremely low moisture retainer, and it is also a good nitrogen gatherer. As a basis for a mulch treatment the hairy vetch is a wonder.

Q.—Do you find absolutely clean cultivation year after year dries the ground out a great deal more than where the cover crop is put in?

PROF. STEWART: Well, that condition has not developed very greatly with us in our experiments; that is, the difference between the clean tillage and the cover crop. That merely applies to our own experiments, and it might not apply to your conditions here. It might be that you need that humus. All theory is in favor of cover crops, but all I can say is that our experiments have not shown what theory would have indicated.

Q.—Do you feel safe in using nitrogen fertilizer on young apples, such as Spies?

PROF. STEWART: We are using the fertilizer on apples, and have not had a winter injured twig.

MR. BROWN: I have a few trees this year that are in close proximity to heavy supplies of nitrogen, and I have got very poor fruit. It is green fruit, and is not matured enough to pack.

PROF. STEWART: That is a very important point in reference to color. A person will simply have to vary his nitrogen supply with the variety, and if he finds that the nitrogen is affecting his color too much he will simply have to reduce the nitrogen. That is about the only way out of it.

Q.—Can you hasten their ripening any?

PROF. STEWART: You can retard their ripening. Phosphoric acid and potash ought to hasten maturity a little bit, but their influence in hastening maturity in the apple has been comparatively small with us.

Q.—In one of your experiments you said the manure increased the yield because of the moisture?

PROF. STEWART: Undoubtedly.

Q.—Wouldn't the application of water irrigation have a much greater effect than some of the fertilizers?

PROF. STEWART: It might. It could not have a far greater effect than some of these fertilizers have had, because the trees were broken down as it was.

Q.—Do you think there would be any more benefit by applying lime to heavy clay land than the results you have shown us?

PROF. STEWART: Well, one of these charts is on a clay loam, quite a heavy soil. That is the one that shows a little benefit from the lime. It is possible it

would have a greater effect on heavy soil than it would on light, but the results have not been sufficient to enable one to make a straight statement to that effect.

THE PRESIDENT: I am sure you have all enjoyed the address by Professor Stewart. He has gone into the matter very fully, and I am sure it has been a great benefit to us to have had him here this afternoon. Professor Harcourt will follow up this discussion now.

PROF. R. HARCOURT: I would like to say how pleased I was to hear Professor Stewart emphasize so magnificently the need of experimenting on our own ground. We find that need absolutely in our case throughout. It is impossible for us to advise a man how he should fertilize his ground for an orchard or for other crops by taking the results of any analysis or any description he may give to us of his soil. We get so many letters of that kind that I have a typewritten sheet written out to answer those letters. I have the form of experiment that we advocate using so that each man may let the particular crop he wants to get answer the question itself, and let it answer the question from his own soil. We give a general type of experiment that can be used in that way, and I say a few words of generalities and inclose this sheet along with it, and it saves me a lot of writing and dictating. We find it is absolutely necessary, no matter how we may analyse the soil, to get back to that point, because the ground after all, or the soil, may contain any amount of potash or phosphoric acid, but the question is, is that in a form which is available to the plant, and we find as a result of these experiments that have been cited that in some cases they were not available. For instance, we found results here in one case of potash getting results where it did not give results in other places, and most likely the potash there was held in some form of combination that prevented it being taken up by the plant, and so with the others. So it is not the amount but the availability, and I firmly believe this, with all our learning, the controlling of the humus and the controlling of the lime contents of the soil are the two great controlling factors in the soil. If you have got plenty of humus in the soil to help conserve the moisture, as a result you get plenty of that material decaying, and you get the acids which are essential to bring the potash and the phosphoric acid into solution. Without these all you have got in the soil under natural conditions will be no use. It is only as we can get the acids that are formed from the decaying organic matter that we get the use of that acid in the soil, and, therefore, the humus must be the controlling factor. Then again the lime, all the reactions that are continually taking place in the soil are more or less influenced by the quantity of lime in that soil, and you will usually find a soil rich in lime an active soil and a good productive soil, while a soil poor in lime is a poor soil. It is just like everything else, it may be overdone in the amount that is applied to any particular soil.

Q.—What is that old lake bottom along the south side of Lake Ontario?

PROF. HARCOURT: I really do not know. We are in that position that we know comparatively little about the characteristics of the composition of the soil in various parts of this Province, but we have under way now some work, or, rather, we are asked to formulate plans whereby we will not be in that position very much longer.

Now, as a result of experiments, or experiments planned, I may say we have a number of orchards in different parts of the country to-day on which we are working. Our plots are all five plot experiments, or six if you like, with a check plot at either side of the experiment with a complete mixture, and then with one of each of these three substances dropped out, making four plots that are fertilized.

We have a number of these throughout the country. This is the second year, and many of these results are not in yet, so that I am not in a position to give you figures; but one peculiar thing I want to speak of in this connection is the point that has already been brought out—the value of nitrogen in apple production. We have an orchard under experiment to which farmyard manure has been applied regularly for some years, and the question came to me, "Why cannot I get better fruit from this orchard?" It was having naturally a tremendous growth of wood with an immature crop at the end of the season and a crop without color. On that ground we applied no nitrogen, but we applied potash and phosphoric acid on one plot, and we left out the potash on another. There were twenty-four bushels on an equal number of trees that had received none of the fertilizer. Where we put in both potash and phosphoric acid we got seventy-five bushels, and on the plots where we left out the potash it dropped to forty-eight bushels. You can see there was quite a difference, and just emphasizes again the point that every man needs to experiment in his own orchard to get the results, and while we need to pay attention to nitrogen, while we want a good supply of nitrogen, it, like many other things, can be overdone and you can get too much of it. One other point I would like to make is just this, that it seems to me under our present conditions I would not like the fruit growers to drop their cover crop when they put in an experiment of this kind. If you put any such experiment in your orchard put it in addition to the best cultivation and the best cultural methods you can in your orchard. Do not apply nitrogen expecting it to take the place of the nutrition that you hope to get out of your cover crops, but keep your cover crops to get all the benefit you can from them and apply this other in addition to them so as to bring out your results. There are a number of other points which might be taken up but as the hour is late I think we had better leave it out.

INVESTIGATION WORK ON PEACH YELLOWS AND LITTLE PEACH.

L. Caesar, Provincial Entomologist, Guelph.

As most of the peach-growers probably know, I spent almost all this summer in the Niagara district in order that I might have a better opportunity to study Little Peach and Yellows and carry on investigation work on these diseases. As many growers no doubt would like to hear what line these investigations took and what results have been obtained, I have prepared the following account of my work.

In studying diseases one naturally tries to discover the cause, but I have not attempted to do so, because I know that if one were to endeavor to find this in the case of either Little Peach or Yellows it would almost certainly mean years of the most careful laboratory and field work with the probability of ultimate failure; for many good students of plant diseases have endeavored to find the cause of Peach Yellows and failed. Moreover, I had learned in the autumn of 1911 that Dr. Duggar, formerly of Cornell University, but now of the Botanical Gardens, St. Louis, was working on these diseases, and he thought he had at last found a clue that might lead to the discovery of the cause. (For the sake of those who think that a powerful microscope would reveal the presence of some very minute causal organism, I may state here that no microscope shows any organism to be present, nor can any organism as yet be got to grow in any culture. So that, whatever the cause is, it is very different from that which produces Pear Blight or any of our other

common diseases.) Feeling, therefore, that the study of the cause should be left to others better qualified for that work, I have devoted my attention to discovering, if possible, in what way or ways the diseases are spread, and at what time or times of the year this takes place, and also how long a period may elapse from the inoculation of a tree until it shows clear symptoms of disease. If we get definite knowledge on these points we can then hope to simplify and improve our methods of control, whether the cause is discovered or not, though we sincerely hope it will be.

In determining how the diseases are spread I have thought of the following: (1) Pits from diseased trees, (2) buds from diseased trees, (3) bees carrying pollen or nectar from diseased to healthy blossoms, (4) rubbing or injuring healthy trees with diseased ones when removing the latter from the orchard or in any other manner, (5) pruning tools used on diseased and then on healthy trees. Experiments have been planned and carried out to test all of these possible methods of spreading Yellows and Little Peach.

Pits. In the autumn of 1911, with the assistance of Mr. Nelson, of Fonthill, and Mr. Harkness, of the Experimental Station, 631 pits from diseased trees were gathered. Mr. Harkness planted 331 of these at the Experimental Farm; six germinated and grew. Mr. Nelson planted 200 at Fonthill; eight germinated and grew. I planted 100 at Guelph; seven germinated and grew, thus making a total of 21 diseased pits in all that grew, or about 3 1-3 per cent. Of the healthy pits used as checks Mr. Harkness got 20½ per cent., Mr. Nelson 45½ per cent., and I got 68 per cent. to grow. The seedlings from the diseased pits, though not quite so vigorous on the average as those from healthy ones, show no sign yet of disease, but will be kept for several years to see whether it develops.

Believing that a further test of pits should be made, I have with the aid of Mr. W. E. Biggar, the provincial inspector, and Mr. Spencer, of the O. A. C., Guelph, gathered a few more than 2,500 pits this fall from trees selected by myself in each case. A few of these trees showed symptoms of disease very distinctly, most of them only moderately so, and one tree from which 400 pits were taken would have escaped the notice of nine out of ten inspectors. The pits were gathered in October, and to make sure that there could be no mistake the fruit in every case was collected directly from the trees. The 400 pits mentioned above are being kept separate to see if any larger percentage of them will grow than of those gathered from trees showing the symptoms fairly clearly.

Buds. Several experiments have proven that Yellows and Little Peach can be spread by using buds from diseased trees, but I thought that we should test this ourselves and see not only how long it would be before the seedlings or trees thus budded would develop the symptoms, but also what variation there would be in the length of this time. Accordingly, ten healthy trees four years old in a young orchard on the Experimental Farm were budded. The buds in each case were taken from healthy looking shoots on diseased trees, about half of them from Yellows and half of them from Little Peach. Each tree had at least four buds inserted into it, all of which took. Each budded branch has been tagged so that track can be kept of it. In addition 100 seedlings from healthy pits were budded in a similar manner so that we might be able to compare the result on these with that on the older trees. Nearly all of the buds on these seedlings also took. The budding was for the most part done by Mr. J. W. Smith's best budder, whose services Mr. Smith very kindly offered to me.

Bees or Other Bloom-frequenting Insects.

To test whether insects could carry the disease at the blooming season nearly 200 blossoms were pollenized in the same careful manner that hybridists use when trying to produce new varieties of fruit. Pollen from four trees that I knew had been diseased the previous year was used on each tree. The 200 blossoms were distributed over nine trees. Of the blossoms thus hybridized 80 per cent. set fruit which remained on at least as long as the so-called June drop. A large proportion then dropped off but some remained and reached maturity. None of these trees have this season shown any signs of disease.

In addition to the hybridizing the blossoms on two other trees had nectar from diseased blossoms added to them. These trees also are still looking healthy.

Rubbing or Injuring Healthy Trees with Diseased.

On August 13th four trees four years old were inoculated by rubbing several branches on each with diseased branches until the bark was ruptured. Again, on September 9th, five more trees of equal age were inoculated in the same manner. On July 31 leaves and fruit from diseased trees were gathered and crushed and a little water added to them. The juice thus formed was filtered carefully and three holes were made with a brace and a small bit in each of four trees. The filtered juice was then poured into each of these and the hole covered over with grafting wax. This experiment was intended as a supplement to the rubbing, because, if in both cases the trees thus treated were to contract the disease, it would show that at least the sap contained the source of contagion, whereas the rubbing alone would not make this so clear. No sign of disease has yet been seen on any of these trees.

Pruning Implement: On May 3rd three trees were inoculated with a saw. In doing so branches were cut from diseased trees and brought to the healthy ones, then a fresh cut was made in each of these and immediately after on several branches on the healthy trees. The cuts were made chiefly on the underside to prevent drying out rapidly. At this date the buds were swelling but none of the blossoms had burst. On July 4th four more trees were inoculated with the saw in a similar way. The trees are all still healthy.

Careful records have been kept of all the trees treated in the above various ways, and the results will be watched with much interest next season. I was not surprised that no positive results were obtained this year, as I did not expect any from what I had learned of the disease from observations and reading. Interesting results from some of these experiments may be expected next year if the disease works in the same way here as in some of the states across the line.

The second main subject of investigation was to determine when the diseases were spread. Fortunately the above experiments, intended primarily to show how the disease is spread, are equally well adapted to show when this takes place. For instance, if the trees on which the blossoms are hybridized with pollen from diseased trees develop the disease in a year or two and the untreated trees all around remain healthy we can feel pretty certain not only that bees can distribute the disease but also that it spreads at least in blooming time. Again, if trees pruned before the buds burst with an inoculated saw do not develop the disease and those pruned a month or so later do develop it we shall have some more data of value.

Our third subject of investigation was to determine how long a period elapses from the time a tree is inoculated until it shows the symptomes of the disease, and what variation there is in the length of this period. This, I believe, is a very im-

portant matter, but fortunately once more nearly all the above experiments will help to give us data on it.

As these experiments begin to give definite result they will prepare the way for further investigations until finally we have succeeded in getting together a mass of reliable information that we hope will be of much service in the control of these dreaded diseases.

In order to eliminate the danger of the trees that are being experimented on contracting disease from other trees of the district, I am arranging to carry on a series of experiments in Norfolk County in a section several miles from where any peach trees are now growing.

Moreover, as the degree to which the nurseries spread the disease is very important, I am planning next year with the co-operation of Mr. Biggar and the other inspectors to accumulate data on this point.

Whatever time I had left after performing the experiments this year was largely devoted to studying more closely the various symptoms of the diseases, helping the inspectors to recognize them and holding demonstration meetings in various sections. These meetings were well attended.

On my invitation, Dr. Duggar, who, as I have mentioned, is investigating the cause of Yellows and Little Peach, visited the district and spent nearly three days with Mr. Biggar and myself studying the various symptoms and other points of interest connected with these diseases in different parts of the Niagara district. I have heard from Dr. Duggar since his return home, and he says he feels more confident than before of ultimately getting to the root of the trouble. During the visit he suggested a few ways of investigation that I hope to take up next year.

In conclusion, I may say that Mr. McCubbin, of the Botanical Department of Ottawa, has started to study these diseases, and I look for much help next year from his co-operation.

Investigations, however, will not cure these diseases, and I cannot urge too strongly upon peach-growers the necessity of destroying promptly every diseased tree in their orchards, whether marked by an inspector or not. I regret to say that while this is being done conscientiously in some districts, in others the growers, even some of the leading men, are very careless and indifferent and doing little or nothing towards encouraging thorough work in their districts.

Mr. Armstrong: Where are those specimens?

Mr. Caesar: There are ten in Jordan Harbor experimental station out against the lake. No disease has shown up at all in that orchard yet. They have about forty seedlings, thirty-eight back in some part of that farm, sixty rods away from any peach orchard, that are budded. Then sixty seedlings at Guelph are budded.

Now, around St. Catharines I am told that the Inspector is not backed up in his work. You men at St. Catharines had some 2,300 trees marked last year, and you have some bad orchards, although you have not had it as bad as Grimsby. The St. Catharines territory has not been covered. You are trying to do far more with one inspector than you can do. In the Grimsby district he has been over it twice or three times. From Jordan Harbor right up as far as Winona every tree is going out, just as it should, but in some of the other districts the trees are not being taken out as they should. Two things are possible. One is to let the men suffer if they are not going to look after them; but that is not fair to the man who is trying to do his best when his neighbour is not trying. The other thing is that the inspector should be ever so much more strict, and every man

rise to a higher sense of his duty in this regard. When an inspector comes around and marks a tree in your orchard, and you do not believe it is diseased, you have the right to appeal to Mr. Biggar and myself, and when we come to an orchard and say a tree is diseased, and you say it is not, you in your limited experience are saying you know more about this disease than we do, and we have been working at it for years. Now, we do not want to be put in the position of forcing you, but there is nothing else for it. I do not know of a single case where Mr. Biggar and myself have decided a tree was diseased that it has turned out wrong. I would like to say to the men in the districts which are too big for one inspector, appoint another inspector. I have heard in some districts there is a movement to hamper the inspectors. Now, do not allow that to go on. I am speaking plainly, and I recognize many men will feel rather hurt in a way, but I do not mean it in that way at all. What I do mean is this, that in your great hurry with your big crops you have neglected what, if you really stopped and thought carefully over it, you would not have neglected.

MR. ONSLOW: Is it not the fact that St. Catharines district is largely composed of other things besides fruit? Grimsby is largely a fruit district. In reference to that remark about Niagara, whose fault is it that this work was not encouraged? Was it the fault of the inspectors or the Townships Councils, or was it equally the fault of the Department in not enforcing it?

MR. CAESAR: I might say, Mr. Onslow, Mr. Biggar and myself said to every Inspector, if you find a man will not take out his trees do not go right at it to enforce it yourself, but send word to us and we will see that that man takes out his trees, and we would be equally fair to one man as to another, we don't care who they are. There have been cases where for experimental purposes trees have been allowed to go in.

MR. ONSLOW: Whose fault is it that those trees have not been gone over three times?

MR. CAESAR: The inspector could not get over them. Take Mr. Pays, for instance. There were a lot of diseased trees there. I called at that orchard nearly two months later, and there were one-third more not marked because the inspector had not been able to get there.

MR. ONSLOW: Can you offer any suggestion by which one Inspector could do better work? Why cannot your Department put on more inspectors?

MR. CAESAR: I hope to visit the Councils when they are appointing inspectors.

MR. ONSLOW: If it is the fault of the Council why is it not the duty of the Department to see that more Inspectors are appointed, or that certain inspectors devote their whole time instead of half their time?

Q.—With regard to inspecting the budding and the pits, is that carried on consecutively? It seems to me the seasons, probably, have a great deal to do with the period of incubation of these things, and perhaps a good deal is due to the unfavorable season.

MR. CAESAR: I hope to duplicate wherever it is feasible every one of these experiments. I am duplicating on pits. Three and third per cent. of the pits are diseased stock. That is much more than in the American reports we have got to grow. We have got at least three times as many to grow as any other investigator I know of.

INSPECTION WORK ON PEACH DISEASES.

W. E. Biggar, Winona.

I will deal briefly with this subject of Inspection of Diseases in Peaches. I consider the two diseases, Yellows and Little Peach the most difficult problem the fruit grower has to deal with in the Niagara district, or any peach growing district. It is a serious question, because where a tree becomes affected with the disease there is no remedy except to destroy the tree. Throughout the district there has been quite a lot of disease during this past year. The inspectors have had, I believe, the most difficult work before them this year that I have ever experienced as an inspector, on account of the conditions which existed, such as winter injury from the severe winter. It was at the beginning of the season by inspection very difficult to be certain whether a tree was diseased or whether it was affected with the severity of the winter. However, with the aid of Mr. Caesar, we finally worked that out, so that I think the local inspectors made but very few mistakes with regard to the disease. I think their work was very accurate, taking it all the way through. Now, as to the inspectors, I think they are doing good loyal work. Of course I know the inspectors get a good deal of criticism, sometimes I think very unjustly. People will say, "Well, here is such and such a man's orchard; it looks almost all of it diseased." And when you come to examine that orchard carefully you will find there is some other cause for the sickly appearance of the orchard. It is not always diseased, but that does not let the inspector out; he gets the criticism that he passed that orchard by and left diseased trees. However, I think, taking it on the whole, the inspectors are doing their work well, as far as I know about it. Through the district, of course, there are sections where I think there is more negligence on the part of the owners of the orchard than there is in other sections, and that is usually where we find the most disease. I cannot impress upon the fruit growers too strongly the necessity of being prompt to remove the diseased trees from the orchard. Even supposing when a tree gets sickly that it is not diseased is it of any value afterwards? If it is weakly and sickly, though it may not be diseased, of what value is that tree to any man? I do not consider it is worth very much, and why the owners of orchards will be so negligent about removing them I cannot understand. Of course they are not all that way. A good many are very prompt, but there are some who are kind of careless, I think, and should look after this work more promptly than they do.

Now, as to controlling the disease it seems to me there are only two methods by which we can ever hope to keep it under control. One is by thorough inspection by inspectors who are thoroughly qualified to do the work and who can go into an orchard and identify each and every sympton that shows it is a diseased tree. This past season we have had perhaps the best assistance we ever had since we have been working as inspectors. Mr. Caesar has been there with us, and I assure you there has been a wonderful improvement in the work of the local inspectors since he came there, and has been assisting them. Originally the inspectors were allowed, as it were, to educate themselves. There was no person to go to them and give them much assistance; but now I think we have a very competent staff of inspectors, and we hope soon to have this disease more under control than in the past. I do not know whether Mr. Caesar mentioned anything to you about the number of diseased trees. I have not a full return yet of the number of trees that we found affected. I have for seven townships, and

in those seven townships there were 15,200 trees marked as diseased trees, and I believe when the full returns are in, it will amount to somewhere near about 25,000 trees. That is about half what it was last year.

I do not know that I can say very much more about the inspection of Yellows. I visited nearly all the nurseries, in fact I think all of them, throughout the Niagara district, and I know there was something said here the other day that would lead people to believe that the nurserymen were careless in fumigating and looking after their stock. I did not visit one nurseryman in this district but who said to me, "I want you to examine our fumigators and our nurseries as well as you can, and see that everything is right; and if there is anything wrong we want to know it." Now, that does not look to me as though the nurserymen were trying to conceal anything. I believe the nurserymen as a rule are doing what they can to put out good clean stock. They have said to me that they like to have me watch the orchards surrounding the nurseries, and if there is anything wrong there we want you to look after them, and I have done so in some instances. I have found there was scale coming into nurseries from adjoining orchards nearby, and these were promptly looked after and they were made to destroy the trees or treat them.

I would like to say a word or two as to the appointment and pay of the local inspectors. It seems to me that it is not entirely satisfactory as it is done at the present time. They are nominated by the municipality, and their nomination sanctioned by the Department, and their pay is regulated by the municipality. Well, some of the local inspectors get $2 a day, some $2.50, some $3 and some $4. I do not know why there should be this difference in their wages if one man is as good as another and doing just as good work. Inspectors do not like to work for $2 a day when men who are mixing mortar and laying brick are getting $4 and $5. They do not relish that very much, and I think there should be some alteration made in the manner of their appointment. I believe it would be in the interest of the fruit growers if the Provincial Government would take over the appointment of the inspectors and pay them. I believe it would be more satisfactory and more business-like if it were done that way, and in addition to that I think it would be better if the inspectors were appointed to some district outside their own neighbourhood. There is a local influence in districts usually where inspectors are working. They have neighbors with whom they have always been good friends, and some of those neighbors are a little negligent and slow about removing the diseased trees, and the inspector does not like to stir up hard feelings. For that reason I believe if the Department would take over the appointmentment of the inspectors the work would be carried on better than it is. However, this is a matter for discussion perhaps, when you have thought the matter over. I know of one instance in a district where one inspector is paid $15 a year for his work. If he did the work that is necessary to be done he would get about 25 cents a day. Now, I do not think we can expect very good results when the work is carried on in that way.

Q.—A moment ago you mentioned there were two methods of controlling these diseases, and you referred to thorough inspection. What is the second?

Mr. Biggar: The prompt removal of the infected trees by the owners of the orchards as soon as they are marked. I could cite dozens of instances where affected orchards have been neglected and the trees allowed to stand. I would like to mention just one instance. About four years ago, before we had any regulations from the inspectors in authority to do anything with regard to Little Peach, I

found an orchard in our district about three-quarters of a mile west of Fruitland, and all I could do was to notify the man that he had disease in his orchard. Of course I could not compel him to remove the trees. There was nothing then in the regulations that gave me any authority to do so. Well, he did not remove that orchard. He left it standing there, and I think it was two years after that before we got authority to do anything with regard to that disease. At the present time I believe there are only two orchards left standing within a mile and three-quarters east and northeast from that orchard I first mentioned, that are still alive. Every peach orchard within a mile and three-quarters of that distance is gone. The whole entire orchard was destroyed with the disease; and that is one very good proof I think that it is a dangerous thing to leave diseased trees in the orchard once you know they are there.

J. B. Fairbairn, Beamsville.

The disease problem that we have heard of this morning is undoubtedly one of the chief factors with which we must all come in contact at the present time. A problem such as this affects the agricultural interests of the community or the locality to a great extent. Our success in growing crops depends very largely on the success we have in overcoming such pests, and to this I would add the willingness of the grower to adopt such practices, or adopt proper practices, to thoroughly and strictly carry out the proper recommendations.

Now, we require inspection of fruit trees for various reasons, but chiefly on account of Little Peach and Yellows. The symptoms are most easily identified during the months of August and September. These are the two months during the entire season when it is easiest to identify it. Very few men, if they are competent, can find sufficient time over ten days or two weeks, as the case may be, to go through their orchards carefully to examine every tree for disease. I know you would say immediately, why, we are working in our orchards every day and we ought to be able to identify a diseased tree. Well, that is true to a certain extent, and yet my honest opinion is that a man who is working day after day in his own orchard becomes so accustomed to the appearance of his own trees that he does not readily detect any abnormal occurrence. The time to detect the disease is in its very earliest stages, and I believe a stranger coming into an orchard will detect far more quickly the early symptoms of the disease than will the owner himself, even though he may be very competent.

On the other hand I believe that too few of our men are really competent to determine the disease in all its forms, particularly in the early stages. My experience has been where we can point out the disease on the fruit or by the fruit we have not any difficulty whatever in convincing that man that his trees must go. I must say it is only very occasionally in our district where we have had the slightest trouble in convincing a man of the identification of both. I have in mind a man in my own district whom I consider knows the disease in all its forms, a man who is a very progressive fruit grower. He is a man who is working on a small acreage but who spends, I was going to say, night and day in his orchard. At any rate he spends all day and part of the night, and I was quite sure when I visited that man's orchard I would not find any disease, because I knew he was very keen to have all trees which were diseased removed immediately. Yet I was very much surprised, indeed, to go in there and mark out of a small number of peach trees ten diseased trees, and those ten trees I may say showed the disease very markedly.

It was not exactly in its early stages. That I think bears out what I have said in regard to a man becoming familiar with the appearance of his trees in his own orchard.

Further than that, the symptoms differ very greatly in different orchards. The symptoms differ perhaps because of different treatment or different cultivation, or because of cropping between the trees, or because of a worn-out condition of the soil. There are very many reasons which affect the disease and consequently affect the symptoms, and while a man might see that his trees were sick he might not feel sufficiently confident to cut them down. These are some of the reasons, as I have said, why we should have inspection.

Then in addition to inspection we must have co-operation on the part of the grower, and I am very much surprised to hear some of the remarks made by Mr. Caesar this morning, and also to get an intimation not very long ago from a certain source that there were districts in which inspectors did not receive the backing that they should receive at the hands of the grower. I honestly say that it came to me as a surprise, because I had not anything but the very best to say about the reception I received at the hands of the growers in my district this year. I was met with the utmost grace. If I may say so, I was met at the gate with an open hand by the growers in every instance. I cannot recall one single instance, and I covered every farm in the township but one—at least every farm in the east part of the township and a good many in the west part—where I was not treated in a very kindly manner, and in the majority of instances they took time to go with us through the orchard. It was a busy time yet in nine cases out of ten the grower took the time to go with us, and stayed with us until we were finished. I suppose they were glad to see the last of us, but at the same time they did not show it.

As an instance of this I would like to say that one man in the district as soon as he knew I was there called his two men and told them to bring the team and the axe. He said, "We are going to spend the day going through the orchard, and we are not going to leave a tree ten minutes after it is marked," and I think when I went out of the orchard at night every tree that I had marked was down and taken out, and it was quite a number.

Another man who had a large orchard of some four or five thousand trees was going away that afternoon and I told him not to bother going with me, that I would get through all right, and leave word with his man as to the trees that were marked and so on. "No," he said, "I am going to go with you." He said, "Time is money with me, but I consider if I can learn anything that will help me to identify the disease in my orchard it is time well spent if I spend the entire day." I cite these two instances to let you know the attitude of the growers in our section; and while ours is a young and growing section, and while there are in the district about 55,000 trees only five hundred trees were marked that year, just about one per cent. of diseased trees. I feel that we have a pretty good report to bring to the meeting. I want to say we are going to try to live up to that. We feel we can keep the disease to its present limits. Of course it is not only the work of the inspector to do this, but the work of the farmers of the community as well. We know what ravages the disease will make if allowed to spread, and I believe every one is anxious to keep it down the very best they can.

I see my time is up, but I would like to say just one word if I may with regard to the appointment of additional inspectors. I came here prepared to give more time to that than anything else, but as Mr. Caesar spoke about it I do not need to

say so much. My own opinion is that twice the number of inspectors would do far more efficient work. Two inspectors working together would have much greater assurance in marking trees. They would cover the ground I think even faster than each man working alone, because I assure you when you get into an orchard of six, seven, or sometimes twelve thousand trees on a hot day in August, and walk up and down those rows looking at tree after tree it gets rather monotonous, and if there are two working together they can cover that orchard in just half the time, and they may now and again meet at the end of the row and look at each other and have a word together, and the work would go along with a great deal more vim.

At the present time the inspection is chiefly confined to peach trees, and I do not think in my own district that a large number of the farmers are receiving the benefit from the inspection that they ought to receive. We cover the territory only once, and we should cover it twice or perhaps three times. There are certain farms I have visited three times, of course. Those were cases where the men were sufficiently anxious about their trees to keep telephoning me day after day and day after day, until they got me to come at the expense of my own work, to go over their orchard the second or third time. There are certain places where I have done that, but with the additional men you could do that with every place. Aside from that there are apple orchards and cherry and plum orchards. Now, in our particular section south of the main road, or the stone road, there is a large portion of the township, I may say, uncovered. I have never visited a farm, and I doubt if the inspector before me ever visited a farm. Now, those men who are raising apples and pears with a certain amount of plums and cherries, ought to receive some consideration or some help at least from the inspection, so far as San José scale or black knot, and so on, are concerned. I feel that these men are entitled to some recognition, and the only way it seems to me they can get it is by the appointment of additional inspectors.

Q.—I would like to ask Mr. Caesar a question as to mottled leaf. You were somewhat undecided in your mind about that?

Mr. Caesar: We have decided that mottled leaf unless it has the other symptoms of Yellows and Little Peach is not a sign of those diseases.

Q.—What is that mottled leaf caused by, or what is it a symptom of?

Mr. Caesar: I asked Dr. Tucker his opinion about that, and he is not sure. It is caused in some cases by excessive moisture in the soil. In many cases it is clearly associated with that. Perhaps Prof. Stewart can give a reason for mottled leaf which is often very bad on Japanese plums, European plums and on peaches.

Prof. Stewart: No, I have had no experience; and anything I might say would only be a guess.

Mr. Caesar: I would like to say one word. I do not want you to get the idea that the St. Catharines district has more Little Peach and Yellows than any other district. They have some beautiful orchards there. I just want to waken the people up there so as not to let it get a good start. The percentage I got was a very small one, and I am trying to save them from ever getting a real bad attack. They must see the necessity of taking vigorous measures, and the same thing applies, as I have said, to Niagara-on-the-Lake, and over at Fonthill. Fonthill had a very bad attack, but Fonthill is very wide awake to-day. They were badly burned at one time, and a child who is burned fears the fire afterwards.

Q.—Speaking of Fonthill our inspectors were taken away from there to pack

peaches. I would like to know how they can do the inspecting when they are taken away to do other work?

MR. CAESAR: Mr. Arnold was one taken away, but he is not a Peach Yellows Inspector. Mr. Nelson found only about eighty trees in his district, so you see it does not apply to the inspectors who are on Yellows and Little Peach to any extent.

There is another thing about the disease this year. The very wet season made it impossible day after day for inspectors to go through the orchards, and therefore the work has not been done as we would like to have it done. That made it very slow. I know Mr. Fairbairn and Mr. Reid spent day after day hoping they would be able to get out. They could have got over it in half the time. In every district we have to have two inspections, or we are not going to control this disease. An inspection in August, when most of the inspecting is done, does not get much more than half the trees. The last inspection should be late in September, and if the season is good right into the first week in October. After that it is not safe to do it.

Q.—Do you find the disease develops much after the peach is ripe?

MR. CAESAR: Yes. Take for example the orchard I referred to a little while ago at Niagara-on-the-Lake. The fruit was beginning to ripen then, and at that time almost all the trees are marked. There had been a few trees missed, and I visited there nearly two months later and I could have marked one third more trees. Supposing there were one hundred marked I could have marked thirty-three more or probably fifty more.

Q.—Do you find the disease on later ripening varieties after the fruit ripens?

MR. CAESAR: So far as I can pass an opinion now, I should say it will develop on any tree so that you can see it if it is almost showing up at the time of the fruit ripening. You see it takes a certain length of time to grow, and if it is nearly appearing at the time the fruit is ripening then it will show up at the end of that fall. It will become more apparent as the season goes on.

MR. ANDREWS: I would like to say a word with regard to the appointment of inspectors. I think it very desirable that the Department think that matter over. In our township it was postponed to the second meeting, and I was hoping the Department might take the matter up. It might very easily happen, and I expect does happen in many townships that the Council is elected from the agricultural districts which are not entirely fruit districts, and there is no interest amongst the Council regarding this work. Therefore, I think it would be very desirable, if it could be done, to take it out of the municipal council's hands. I do not say there is anything like this in our Council, but still it might easily happen in a township.

MR. ROBERTS: Might I suggest that that matter be left with the Niagara Peninsula Fruit Growers' Association? I believe the first suggestion was that the appointment should be made by the Government, but it was altered. Now, I think as the peach growing is all in the territory of that Association it would be a wise thing for the Niagara Peninsula Association to deal with it rather than this Association.

MR. CAESAR: Before you ask the inspectors to be appointed by the Province you will have to agree among yourselves what you want. It must be unanimous or almost unanimous on the part of the fruit growers before the Government will move in the matter. I feel satisfied of that.

THE CHAIRMAN: There is a resolution in the hands of the Resolutions Committee, which they have passed upon favorably, referring to that very point, and it will come up a little later.

INFLUENCE OF CULTURAL METHODS AND COVER CROPS, ALONE AND WITH FERTILIZATION, UPON THE YIELD, GROWTH AND COMMERCIAL QUALITY OF APPLES.

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At the outset it may be well to call attention to the fact that the relative value of the various cultural methods used in orchards is not dependent upon anyone's opinion. It is not a matter of sentiment, nor can it be settled by vote. It cannot even be settled generally by the results of any single experiment or group of experiments, although they should be very valuable. It can be settled with certainty, for any given orchard, only by asking the trees. Whether this is done by the investigator or by the orchardist himself, however, the question must be put perfectly fairly, with neither prejudice nor preference, and with the sole idea of getting the actual answer of the trees, and stating it wholly impartially and without the slightest personal interest in the outcome.

This is the attitude that we have undertaken to maintain in all our experimental work, and especially in the experiments with cultural methods and cover crops. Moreover, the present report is to be considered only as a report of progress and not as a statement of final conclusions. The writer is free to confess that some of the present results are different from what was anticipated, and hence is reserving judgment on them until further results are secured. But our anticipations are not necessarily correct, and the present indications may not be changed. Hence our present results are given just as they stand, with such comments and cautions as now seem pertinent to the writer.

In the discussion following, it will be observed that our present results are derived from nine experiments, located in different parts of the state on seven different types of soil, and involving 1,991 trees, 588 of which (in experiments 331, 333 and 337) were planted in connection with these experiments. Four of the experiments—numbers 217, 218, 219 and 221—were started in 1907, and the remainder in 1908. The growth data are obtained from annual measurements of all the trees at definite points on the trunks, and the data on yields are secured from the annual production of fruit, which is studied from three view-points—those of yield, color and average size. The total amount of fruit thus examined, during the past five years, is 1,149,702 pounds, or about 23,000 bushels. The locations, soils, present ages of trees, and other general features of our cultural-method experiments are shown in Table I.

TABLE I.—LOCATION AND OTHER DATA ON ORCHARD CULTURE EXPERIMENTS, CONDUCTED BY THE PENNSYLVANIA STATE COLLEGE.*

Experiment. No.	County	Soil Types.	Varieties.	Age 1913	No of Trees.	No. of Treatments.
217.....	Franklin ...	Montalto loam	York, Imp. and Gano..	20 yrs.	358	12
218.....	Franklin ...	Hagerstown clay loam..	York and Albermarle.	14 & 21	400	12
219.....	Bedford	Frankstown stony loam	York, Jonathan B. Davis and Gano	10 to 12	320	12
221.....	Wyoming ...	Chenango fine sandy loam	Baldwin and Spy.....	40	115	6
331.....	Centre.....	Hagerstown silt loam..	Baldwin, Stayman and York	5	288	8
333†....	Centre.....	Hagerstown silt loam..	Baldwin, Stayman and York	5	120	12
336.....	Chester	Chester loam.....	Smokehouse and Stayman	10	105	3
337.....	Mercer	Volusia silt loam	Baldwin, Spy & Rome	5	180	4
338.....	Lawrence...	Volusia silt loam	Baldwin	24	105	3
Totals..	7	7	10	.....	1,991	.....

*The addresses of the owners of the orchards in which these experiments are located are as follows: 217, J. H. Ledy, E. Fayetteville; 218, Ed. Nicodemus, Waynesboro; 219, Jos. R. Sleek, New Paris; 221, F. H. Fassett, Meshoppen; 331 and 333, Department of Experimental Pomology, State College; 336, A. D. Strode, Westchester; 337, Rev. A. M. Keifer, Greenville; 338, J. B. Johnston, New Wilmington.

†Experiment 333 is devoted entirely to a comparison of cover crops, with special reference to their effect on the trees.

GENERAL PLAN OF THESE EXPERIMENTS.

The general plan of our cultural-method experiments is shown in Figure I. Its main purpose is to determine what combinations of culture and fertilization give the best results under the different conditions involved, and eventually to determine why these results are obtained. The plan is followed in full in the first three experiments of Table I., with only minor deviations in such matters as numbers of trees and relative positions of the plots. In the other experiments, for various reasons, certain of the treatments have been omitted, and in the young orchards of experiments 331 and 337, single plots involving intercrops have been added. In experiment 333, the entire attention is given to a comparison of cover crops, one of which is a permanent cover and has received tillage only at the beginning of the experiment. The essential features of these modifications can be seen in the treatments listed for the different experiments in the tables that follow:

I. Clean tillage. 40 trees.	IV. Tillage and cover crop. 40 trees.	VII. Sod-mulch. 40 trees.	X. Sod. 40 trees.
II. Tillage and mauure. 20 trees.	V. Tillage, cover-crop and manure. 20 trees.	VIII. Sod-mulch and manure. 20 trees.	XI. Sod and manure. 20 trees.
III. Tillage and commercial fertilizer. 20 trees.	VI. Tillage, cover-crop and commercial fertilizer. 20 trees.	IX. Sod-mulch and commercil fertilizer. 20 trees.	XII. Sod and commercial fertilizer. 20 trees.

Fig. I.—Plan of Pennsylvania Orchard Experiments on Cultural Methods, Cover-crops, and Manures.

As indicated in Figure I. and Table I., our complete experiment on cultural methods compares the four principal methods of managing orchard soils and it is duplicated, wholly or in part, in several localities on a wide range of soils. Each method occurs without fertilization and also with it in two forms, both applied annually. The stable manure is added at the rate of 12 tons per acre, although 8 to 10 tons would probably be ample. The commercial fertilizer carries all three of the elements usually considered important, at the rates of 30 pounds of actual nitrogen, 60 pounds of "phosphoric acid" (P_2O_5), and 100 pounds of "potash" (K_2O) per acre. About half of the nitrogen is carried in nitrate of soda and the other half in dried blood, requiring about 100 pounds of the former and 150 pounds of the latter. The phosphorus is carried in acid phosphate and the potash in the high-grade muriate, containing about 50 per cent. (K_2O).

At present retail prices, such a fertilizer costs about $12.80 per acre. Here, again, our results indicate that a reduction of at least 10 pounds in the phosphoric acid and of 50 to 75 pounds in the potash would usually be equally efficient, and would effect a saving of about $2.60 to $3.65 per acre. In ordinary practice, also, part or all of the nitrogen might be obtained by growing legumes or by the use of manure, although this has not always proved to be really economical. The manure used in our experiments—at $2.50 per ton, which is about as low as it can be obtained and applied—costs nearly 2½ times as much as the fertilizer we are using and its benefits do not average materially better. More actual plant food is also being added in the manure, since the amount applied should carry about 120 pounds of nitrogen, about 80 pounds of P_2O_5, and 110 to 115 of K_2O.

All the tillage plots are plowed early in May and are kept cultivated until about the middle of July, when those receiving the cover crops are seeded to such plants as crimson or medium red clover, and hairy vetch. On the other tillage plots, cultivation is stopped at about the same time as on those receiving covercrops, but no seeding is done and only such vegetation as comes up naturally is obtained.

On the mulch plots, all herbaceous growth remains in the orchard, and it is mowed at least twice during the season. The first cutting is raked to the trees as a mulch, and the second is left where it falls. In the older orchards also, about three tons per acre of outside materials, such as old straw, swamp hay, buckwheat straw, or other vegetation, are brought in annually to form an additional mulch around the trees. In the younger orchards much less outside material is needed, and in some of them a satisfactory mulch has been maintained from the growth between the rows, after one or two initial applications from the outside. Our mulch method, therefore, differs somewhat from the so-called "Hitchings" plan, the difference being primarily in the maintenance of a definite mulch under the trees, with materials brought from outside sources when necessary. As a means of conserving moisture, the definite vegetation mulch is very much superior to the other plan.

Some real protection against mice must be provided in any mulch system. This can be done by screens, poisons, or proper coatings, and especially by maintaining a clear space for about a foot out from the bases of the trees. In ordinary practice, also, the best results with the mulch system can doubtless be obtained by using leguminous plants of relatively low moisture draft, such as hairy vetch, to act as the permanent cover and to furnish at least part of the mulch. Although essentially an annual, this plant frequently lasts fairly well for two or more seasons after a single seeding. This is especially true after the soil gets properly in-

oculated, and where the winters are not too severe. We also know of an orchardist who is apparently maintaining it permanently by giving it a rather thorough discing about mid-summer or after the seeds have been matured in considerable abundance.

Results in Young Orchards.

The effect of wood growth thus far obtained in one of our young orchards at the College is shown in Table II. These trees were planted in the spring of 1908, in a rather depleted soil of limestone origin. In the first five plots, the soil was plowed in the fall of 1907, and prepared about as for corn before planting in the following spring. In the last three plots, no tillage was given either immediately before planting nor since. The trees were simply planted with a spade in the thin, old pasture, and a mulch of about 10 pounds of straw was placed around each tree, together with screen protectors against mice. Since then there have been one or two slight additions to the mulch from outside sources, but in the main it has been maintained satisfactorily by the inter-growth, in the manner indicated above. The average gains made by the trees under these different treatments for the first five years are shown in Table II.:

Table II.—Influence of Cultural Methods on Growth, Young Orchard.

(Average increase in trunk girth, first five years, in Experiment 331.)

Plot.	Treatment.	Average Gain.	Gain over Clean Tillage.	
		Inches.	Inches.	Per cent.
1*	Clean tillage	3.68	.....	.....
2	Tillage, intercrop and cover crop	3.67	—.01	—0.27
4	Tillage and cover-crops	3.61	—.07	—1.90
5	Tillage, cover-crops and manure	4.51	0.83	22.56
6	Tillage, cover-crops and fertilizer	3.92	0.24	6.53
7	Sod-mulch	4.61	0.93	25.27
8	Sod-mulch and manure	4.86	1.18	32.07
9	Sod-mulch and fertilizer	4.85	1.17	31.80

*The numbers of treatments here correspond with those stated in Figure 1, except in the present plot 2. It involves an intercrop, and hence is different from any treatment named in our general plan.

In this table and also in the field, it is very evident that the untilled trees have made the best growth in the present experiment. This may be partly due to the absence of root pruning under the mulch, but the chief benefit thus far seems to be connected with moisture conservation, rather than with the plant food added. This appears in the fact that the only tillage treatment which has shown much improvement in growth is the one in which manure is applied, and even its gain is surpassed by the mulch alone in plot 7. In plot 8, where the manure is added to the mulch thus practically eliminating its moisture-conserving effect, its gain over the mulch alone is only a quarter of an inch on the average, or a gain of about 6½ per cent which may be properly credited to its plant food effect. This plant-food benefit is practically duplicated by the fertilizer applications of plots 6 and 9, the remaining benefit on the latter being apparently due to the mulch.

In plots 1, 2, and 4, there is very little difference—less than a tenth of an inch in the averages. The slight advantage now possessed by the clean tillage alone is again probably connected with its lower demand for moisture as compared with the

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cover crop used in plot 4. It is notable however, that the net influence of the cover crops in this case has been to check rather than to benefit the growth of the trees. To the close of the fifth year, therefore, the cover crop has made no visible return for itself, so far as the trees are concerned. It has consisted chiefly in a mixture of red and crimson clover sown about July 10th to 20th, and only the last three covers have been really good. In plot 2, the intercrops have been potatoes, peas, mangel wurzels, and sweet corn, with the fertilization considered best for each. They were kept at a reasonable distance from the trees, and the intervening spaces were cultivated until midsummer, and again when the cover crops were sown, which was after the intercrops were removed and hence was usually rather late. None of the intercrops have proved especially profitable, and neither have they proved any serious detriment to the trees, as compared with the other tillage methods, since their check to tree growth is slightly less than that of the cover crops sown in the midsummer. These results are similar to those obtained by Emerson at the Nebraska Station, and reported to the close of the second year in 1903, in their bulletin 79, pages 14 to 17.

Results in the Mercer County Orchard.

Additional data are available from another experiment started by us in 1908 in Mercer County, the latter portion of which is fairly similar to the experiment just considered. In the present experiment, the treatment of plot 12 corresponds with number 2 in the experiment just considered. The usual tillage and cover crops have been maintained on plots 1 to 12, using rye chiefly as the cover, on account of the lateness of some of the intercrops. Plot 13 has received tillage alone, and 14 has been mulched as in experiment 331, though more often. The results on growth are shown in Table III.:

Table III.—Influence of Fertilization and Cultural Methods on Growth (Young Orchard).

(Average increase in trunk girth, first five years, Experiment 337.)

Plot.	Treatment.	Average Increase.	Gains over Normal Growths.	
		Inches.	Inches.	Per cent.
1	Check (unfertilized)	3.28	.....	.....
2	Nitrogen and phosphates	3.78	.44	13.17
3	Nitrogen and potash	3.51	.11	3.24
4	Check	3.47	.....	.....
5	Phosphate and potash	3.94	.14	3.68
6	Complete fertilizer	4.73	.60	14.53
7	Check	4.47	.....	.....
8	Manure	4.57	.32	7.53
9	Lime	4.61	.58	14.39
10	Check	3.91	.....	.....
11	Tillage and cover-crops	3.88	.28	7.78
12	Tillage and intercrops	3.60	.....	.....
13	Clean tillage	3.72	.13	3.62
14	Sod-mulch	4.32	.72	20.00

Here, again, the trees receiving the mulch are showing decidedly the best growth, though their advantage is not quite so great as in experiment 331. The cover crop in this case is proving slightly better than clean tillage alone, probably because the relative importance of moisture and plant food seems to be reversed here. But the advantage on the covercrop plot is still too small to show any profit. The intercrop here has been vegetables—chiefly potatoes, beans, and peas. They show the lowest tree growth of any of the cultural methods, but their deficiency is very slight, and it is probably chiefly due to their location, which has been somewhat wetter than the others. This has now been corrected by tile drainage.

As already intimated, the conservation of moisture seems to be of less importance than plant food in this orchard. This is not surprising to one familiar with this Volusia soil type and also with local conditions. Even at that, however, the response to fertilization shown in the first ten plots is somewhat greater than we had expected in so young an orchard, and in a similar experiment at the College this response is not duplicated. The latter result is more natural in the case of young trees for several reasons. The particular demands of the trees have been operating for only a short time, most of the food of the leaves is annually returned to the soil, the mineral content of wood is rather low anyhow, and in reality comparatively little of it is being formed in a young orchard. For these reasons we usually do not expect much response to fertilizers in the case of young trees.

The response here is rather irregular, but in general it indicates the value of nitrogen and phosphates, which corresponds with our results on this same soil type in the Johnston orchard, in which older trees and both yields and growths are involved. The chief irregularity here appears in plots 8 and 9, in which manure is showing less effect than we would naturally expect in the light of their behavior elsewhere. This irregularity appears to be much greater in the percentages than in the actual average gains on these two plots, an effect which is brought about by the abnormal strong growth on the check plot 7, possibly due in part to leaching or cross-feeding from plots 6 and 8. Beyond this, however, we can offer no further comments on the present results, and we are awaiting further returns.

Results from Cover Crops at the College.

Similar data, bearing especially on the value of cover crops, are available from another of our experiments at the College. The crops used in this experiment are stated in Table IV.

These crops are plowed under annually and the usual orchard tillage is given on all plots excepting the alfalfa. The latter plot was plowed only at the beginning of the experiment, at which time the soil was limed, manured and inoculated and otherwise prepared as usual for alfalfa. The liming also was extended to the other plots. The initial stand of alfalfa was unsatisfactory, and it was therefore turned under at the beginning of the following season and immediately reseeded to the same crop. Since then nothing has been done with this plot, except to cut the alfalfa two or three times a season and apply as a mulch about the trees. The mulch obtained in this way has been considerably more than was needed to keep down the growth immediately around the trees, and some of it therefore has been hauled away. As the mulched area enlarges, however, this condition will not continue. The relative value of the various crops, as indicated by the growth of the trees, is shown in Table IV.:

TABLE IV.—INFLUENCE OF COVER-CROPS ON TREE GROWTH (YOUNG ORCHARD).

(Average increase in trunk girth, first five years, in Experiment 333.)

Plot	Cover Crop.	Average Increase.	Gain over original size.	Rank.
		Inches	%	
1a	Med. Red Clover	3.82	83.65	12
1b	Mammoth Red Clover	3.73	92.28	11
2a	Alsike	3.78	104.32	9
2b	Crimson	4.34	145.40	3
3	Hairy Vetch	4.42	160.07	2
4a	Cowpeas	3.94	75.11	13
4b	Soy Beans	4.18	101.94	10
5	Oats and Peas	4.28	135.16	7
6	Rye	4.07	133.91	8
7	Millet	4.42	138.92	5
8	Rape	4.27	139.89	4
9	Buckwheat	4.58	137.30	6
19	Alfalfa	5.09	206.63	1

Here, again, it will be noted that the mulched and untilled trees are distinctly superior to the others in their growth. As it is also shown that alfalfa can be safely and satisfactorily used in a young orchard at least, when its growth is prevented by a mulch from competing directly with the tree roots.

For use as a permanent cover and as a basis for a mulch, alfalfa is thus shown to be a very satisfactory plant. Its nitrogen-fixing and its perennial habit are much in its favour, when used as indicated above, but its strong affinity for moisture and also for the nitrogen in the soil would suggest caution in using it in direct competition with tree roots. More work is needed on this point, however, and much more work is needed on the relative values of various plants for permanent orchard covers and mulches, and on the best methods of handling them. Almost nothing has been done along the latter line. Hairy vetch, as noted above, has many of the qualities most needed for this purpose, but definite and comparative data on it thus far as lacking.

Among the annual covers, used along with tillage, the best tree-growth has been made in connection with hairy vetch. This is not surprising, when we remember that it furnishes nitrogen and has a very low demand for moisture—two of the most important requisites for a plant to be associated with trees. The surprising moderation of its moisture draft in comparison with other crops can be seen readily in the furrow slice when these plots are crossed with the plow. We have had cases in which the soil under the rye and alsike plots was practically dust dry, while that under the vetch was turning up almost too wet for plowing. Under these conditions, the clovers were about intermediate in the moisture content of their soils, with the advantage somewhat in favor of the crimson, especially after seed-formation had begun and their vegetative growth had been checked, while the conditions under the frost-killed annuals were more like those under the vetch.

The importance of these differences in moisture can be appreciated when it is remembered that only the moisture of the soil in excess of 8 or 10 per cent. is available to plants. On some of these plots the trees were evidently practically in a state of drought, while those on the vetch plot were almost too well supplied with moisture.

Crimson clover has come next to the vetch in its relation to tree growth. This again is not surprising, but the low position of the mammoth and medium red clovers is wholly unexpected, since they seem to be very much like the crimson clover in their more important characters. It seems quite probable that the growth deficit on the latter plots is due to some unfavorable feature of the soil rather than to the clovers, because their growth has not been very satisfactory until the last two seasons. It is also possible that the greater amount of winter-killing on the crimson plot, which reduces the growth and moisture-loss in the spring may have something to do with its advantage.

In the case of all the other crops, the present effects on the trees are doubtless largely due to their relative effects on the moisture supply, which has already been noted as very important in this orchard, in Experiment 331. The rye influence has not been so bad as might be expected, because it has been sown late—not earlier than the first of September, and it has always been mowed immediately around the trees when it began vigorous growth in the spring. The cowpeas and soy beans, on the other hand are sown some time between June 25th and July 5th. Cultivation is therefore reduced and the crops make a vigorous growth, thus undoubtedly competing rather seriously for moisture and materially checking the fall growth of the trees. The gains in nitrogen and humus from these crops, therefore, have evidently not yet compensated for their reductions in the moisture supply.

The gains with the rape, millet and buckwheat are larger than might be expected, and in the case of the latter cover they may be partly due to a slight advantage in location. Here again, however, our results with this class of crops are not materially different from those of Emerson at the Nebraska Station, which were published in 1903 and 1906 in their bulletins 79 and 92. These crops are all frost-killed annuals, though the rape is much more resistant and usually a few plants will survive the winter. They therefore do not compete for moisture in the spring which seems to be to their credit. Their competition in the fall, also, has not been so serious as that of the other frost-killed crops here.

As winter covers, the millet is the best of these three—chiefly because of its greater ability to hold the snow—and the rape is the poorest. The latter usually withers away and disappears almost completely during the winter. The buckwheat, also, furnishes but little direct protection to the soil, but it does seem to exert a mysteriously good influence on its physical condition, making it looser, mellower, and more congenial to moisture. Its general effect is hardly as good as that of millet, however, and even the latter does not yet impress the writer nearly so favorable for our conditions as the hairy vetch, and possibly the crimson clover. From present indications, however, and with their low cost of seed, either millet, rape, or buckwheat is likely to be much more valuable in many cases, than many of the plants now sown for orchard covers.

Summary for Results in Young Orchards. Looking back over these experiments, we see: (1) that the mulched and untilled apple trees have uniformly made a better growth during the first five years than any of the trees receiving the usual tillage and cover-crops. Similar results are reported from the Ohio Station, in their bulletin 171, page 207.

(2) As compared with clean tillage, followed by weeds or other natural growth, the addition of cover crops has not yet resulted in a material gain. In certain cases, they have even seemed to check the growth of the trees somewhat.

These and the results immediately following are similar to those reported from the Nebraska Station in their bulletins 79 and 92.

(3) The addition of vegetables or other tilled intercrops, accompanied by proper fertilization, has not materially reduced the growth of the trees, as compared with other tillage methods. In one case the resulting growth was slightly better than that of the adjacent trees receiving tillage and midsummer covercrops.

(4) Considerable variation has appeared in the value of covercrops, as measured by their effects on tree growth. Thus far, hairy vetch and crimson clover have proved best among the leguminous covers, and millet, rape and buckwheat have been best among the non-leguminous. Their influence on the moisture supply, in both fall and spring, is often more important than their relation to humus and plant food.

(5) Alfalfa for five years has proved very effective as a mulch producer and as a permanent orchard cover, when its growth is prevented from competing directly with the tree roots. The exact effects of the latter competition and the relative values of alfalfa and certain other plants as permanent orchard covers have not yet been determined.

Results in Orchards of Early Bearing Age.

The next group of results is obtained from orchards ranging from six to twenty years old, if we begin with the age of the youngest at the start and finish with that of the oldest at present. The experiments directly concerned here are the first three indicated in Table I, and they each involve the entire plan shown in Fig. I. These experiments were started in 1907, in orchards already planted, and hence it was not always possible to get all the conditions as uniform as might be desired. Such irregularities as are present, however, have been corrected for in our calculations so far as possible. Owing to some serious attacks of "collar-rot" and other diseases, also, one of these experiments, M217, was terminated in 1912 and a similar one started in another part of the orchard.

The results thus far obtained from those experiments on the yield, growth, average size and color of apples are shown in Tables V, VI, VII, and VIII, respectively. The yields, color and average size are given for the 5 year period from 1908 to 1912 inclusive, thus omitting the yields of 1907 which naturally were affected but slightly, if at all, by the treatments of the first year. In the growth, however, the averages are given for the entire 6 year period beginning with 1907. The yields are obtained by weighing and recording all the fruit from each tree, and the growth is determined by measuring all the trees practically annually at definite points on their trunks.

The data on average size and color are obtained by the random-sample method. This means that as the fruit is picked and weighed, a sample is taken at random from each basket and of sufficient size to make at least two bushels of fruit of each variety from each plot. This sample is weighed, counted and carefully examined for amount of color. The averages for each year on all characters except growth are brought together and averaged to obtain the present data on each experiment. These mean values in turn are averaged in each of the tables to obtain the various averages shown in them. In the growth tables, the figures given are the average increases in trunk girth for the whole period covered. The results secured are shown in the following tables:

TABLE V.—INFLUENCE OF CULTURAL METHODS ON YIELD (YOUNG BEARING ORCHARDS).

(Average annual yields per acre during last five years, 1908-1912.)

Treatment.	Experiment.	Tillage.	Cover Crop.	Mulch.	Sod.
		bu.	bu.	bu.	bu.
WITHOUT FERTILIZATION	217	96.0	121.0	174.3	140.1
	218	129.5	110.4	108.5	110.4
	219	21.9	23.6	55.5	19.9
Average per Acre	.....	79.1	85.0	112.7	90.1
Rank	.....	4	3	1	2
WITH MANURE	217	169.1	151.5	213.0	260.5
	218	155.8	145.2	105.9	115.9
	219	52.3	30.2	59.1	35.0
Average per Acre	.....	125.1	109.0	126.0	137.1
Rank	.....	3	4	2	1
WITH COMPLETE FERTILIZER	217	170.4	195.3	218.2	187.7
	218	182.3	133.3	115.3	126.6
	219	47.5	53.7	44.4	33.5
Average per Acre	.....	133.4	127.6	129.3	115.9
Rank	.....	1	3	2	4

TABLE VI.—INFLUENCE OF CULTURAL METHODS ON GROWTH (YOUNG BEARING ORCHARDS).

(Average increases in trunk girth, six years, 1907-1912.)

Treatments.	Experiment.	Tillage.	Cover Crop.	Mulch.	Sod.
		In.	In.	In.	In.
WITHOUT FERTILIZATION	217	9.10	9.69	9.05	8.92
	218	9.89	10.09	10.71	8.78
	219	10.01	8.94	10.87	7.65
Average gain	.....	9.67	9.57	10.21	8.45
Gain over sod	.....	14.4%	13.3%	20.8%	.....
Rank	.....	2	3	1	4
WITH MANURE	217	9.88	9.13	9.19	9.06
	218	11.15	10.32	10.52	10.55
	219	11.65	11.20	11.75	10.06
Average gain	.....	10.87	10.22	10.47	9.89
Gain over sod	.....	28.6%	21.00%	23.9%	17.00 %
Rank	.....	1	3	2	4
WITH COMPLETE FERTILIZER	217	9.58	10.22	10.29	8.51
	218	9.38	9.63	11.25	9.63
	219	11.19	11.37	11.92	10.08
Average gain	.....	10.05	10.41	11.15	9.41
Gain over sod	.....	18.9%	23.2%	32.00%	11.4 %
Rank	.....	3	2	1	4

TABLE VII.—INFLUENCE OF CULTURAL METHODS ON THE SIZE OF APPLES (YOUNG BEARING ORCHARDS).

(Average weights of fruit in ounces, five years, 1908-1912.)

Treatments.	Experiment.	Tillage.	Cover Crop.	Mulch.	Sod.
		oz.	oz.	oz.	oz.
WITHOUT FERTILIZATION	217	4.90	4.82	5.22	4.94
	218	5.68	6.01	6.14	5.68
	219	3.81	3.73	4.74	4.30
Average size	.....	4.80	4.85	5.37	4.97
Gain over sod	.....	—3.4%	—2.6%	8.04%	.....
Rank	.....	4	3	1	2
WITH MANURE	217	5.53	4.98	5.42	5.42
	218	6.15	6.26	5.91	5.84
	219	4.63	4.43	4.83	4.56
Average size	.....	5.44	5.22	5.39	5.27
Gain over sod	.....	9.5%	5.03%	8.44%	6.03%
Rank	.....	1	4	2	3
WITH COMPLETE FERTILIZER	217	4.85	4.99	5.72	5.41
	218	5.48	6.00	6.44	5.83
	219	4.55	4.27	4.52	4.63
Average size	.....	4.96	5.09	5.56	5.29
Gain over sod	.....	—.2%	2.4%	11.9%	6.44%
Rank	.....	4	3	1	2

TABLE VIII.—INFLUENCE OF CULTURAL METHODS ON THE COLOR OF APPLES (YOUNG BEARING ORCHARDS).

(Average per cent. of fruit colored one-half or more, five years, 1908-1912.)

Treatments.	Experiment.	Tillage.	Cover Crop.	Mulch.	Sod.
		Per cent.	Per cent.	Per cent.	Per cent.
WITHOUT FERTILIZATION	217	71.1	67.5	77.1	81.0
	218	76.4	83.2	74.8	76.0
	219	77.5	72.6	82.9	86.2
Average color	.....	75.0	74.4	78.3	81.0
Per cent. gain over tillage alone	.....	.....	—0.7	4.4	8.1
Rank	.....	3	4	2	1
WITH MANURE	217	64.0	68.8	64.3	68.9
	218	64.5	73.9	69.6	74.7
	219	66.0	74.5	63.3	77.2
Average color	.....	64.8	72.4	65.7	73.6
Per cent. gain over tillage alone	.....	—13.6	—3.5	—12.35	—1.8
Rank	.....	4	2	3	1
WITH COMPLETE FERTILIZER	217	64.6	64.6	69.7	72.7
	218	74.7	75.7	69.6	70.0
	219	70.0	71.6	74.2	77.3
Average color	.....	69.8	70.6	71.2	73.3
Per cent. gain over tillage alone	.....	—6.9	—5.8	—5.1	—2.2
Rank	.....	4	3	2	1

These results are naturally much more complicated than those in the young orchards considered above. The differences, also, are less distinct and much less uniform in their trend in many cases, and the relative values of the several treatments are more variable in the different soils and localities. Part of this variability is doubtless connected with the natural unsteadiness, in yield especially, that is generally characteristic of trees in their early stages of bearing. The extent and importance of the latter influence, however, can only be determined by further results and perhaps by additional experiments.

But in spite of the present difficulties, a few points are fairly clear. In the first place, it may be noted that the sod treatment has uniformly resulted in the poorest growth and the best color of any of the treatments. This is doubtless simply due to its hastening influence on maturity. On yield, thus far, the sod has usually exerted a stimulating influence, which is especially noticeable in connection with manure. The exceptionally high average in this case, however, can be traced primarily to the unusual yields in experiment 217, and in the other two experiments it is notable that four out of six of the other treatments with manure are against this average. The same is true of the sod average obtained in the series without fertilization, as shown in Table V.

The present yield benefits from sod, also, are evidently being secured primarily as a result of mild injury, as is shown by the fact that sod trees are making the least growth of any of the treatments, and in the series receiving commercial fertilizer they are also showing the lowest average yield. Grass sod growing over tree roots, therefore, must generally be considered an objectionable treatment.

The Value of a Mulch: In terms of fruit, it will be noted in Table V that our annual mulch applications alone have given an average increase of about 35 bushels of apples in two of the experiments, and has resulted in no gain over sod in the third. These differences might be greater if the trees were larger and in another experiment on older trees, as shown in Tables IX and XIII, it will be observed that the mulch has given a maximum annual gain of 76 bushels per acre for the last four years. In the absence of fertilization during three of those years, the average annual gains from the mulch were 22 bushels per acre, which also happens to be the average shown by it for all three of the experiments in Table V.

When fertilization is added in these young or "adolescent" orchards, however, the benefits from the mulch have usually been reduced, and in the presence of manure they have disappeared entirely, so far as the average yield is concerned. In other words, on these medium-sized trees, the three-ton mulch has apparently been heavy enough to interfere somewhat with the action of the manure. This interference has been less with the commercial fertilizers, especially in the case of growth, and it does not appear at all as shown later in Experiment 221.

From the present data, therefore, it appears that such a mulch as we are using can not be relied upon for annual gains of more than 20 to 35 bushels of apples per acre in the younger orchards, and not more than 75 to 80 bushels in those more mature. From this it is evident that one is restricted to the use of relatively cheap materials in maintaining the mulch, if it is expected to show a definite profit. Where the materials for it can be grown between the rows, or can be obtained in such form as swamp hay, buckwheat straw, or possibly damaged straw of other kinds, its use seems to be practical in many cases, though not in all.

As compared with the other treatments in these experiments, it will be noted that the mulched trees are usually retaining their superiority in everything but

color of the fruit. Their margin is considerably smaller, however, than that in the recently planted orchards discussed earlier, and in a few cases it disappears entirely in favor of some of the tillage treatments. The latter cases are found chiefly in the heavy soil of experiment 218, which is rather unexpected because this soil is almost the same as that in our experiments 331 and 333 above, in which the mulch has proved very satisfactory.

Incidentally it may be noted that thus far the tillage and covercrop treatment has surpassed the mulch in but a single average and that is the rather surprising one of color, when used in connection with manure. In a few other individual cases—especially in experiment 218—the covercrops have also excelled slightly in certain other characters. In general, however, with the exception of experiment 218, the mulch treatment has proved very satisfactory for orchards of the present age, when the cost of materials is not too high.

The Value of Cover Crops: Just as in the young orchards considered above, cover crops again have very largely failed to come up to expectations. In yield, as compared with tillage alone, they have shown a couple of 25 bushel increases—both in experiment 217. In practically all other cases, however, their gains either have been very small or totally lacking, with the results favoring the other treatments.

These results again may be connected, to some extent, with local conditions and with the unsteadiness and youth of the trees, though the exact importance of these influences is not at all certain. In two of our older orchards, experiments 221 and 338, the benefits of tillage and cover crops together have seemed to be quite important, amounting to about 122 bushels per acre annually as compared with sod in the latter case.

Just how much of this is due to the cover crop, however, can not be determined from the particular combinations that are under comparison in those experiments. On the other hand, the present series does contain comparisons bearing directly on the value of cover crops; they give the average annual returns for 5 years from three experiments on three markedly different soil types; and their indications are certainly not without significance. These indications are to the effect that many orchards, and especially those in the early stages of bearing, are not likely to be materially benefited by the addition of cover crops. Where the humus is very deficient, and perhaps in older orchards, cover crops may be expected to give better results.

Other matters, such as the relation of cultural methods to fertilizer response or utilization, the influence of fertilization in reducing the differences between the various cultural methods, the relative values of manure and the present commercial fertilizer in connection with the different treatments, and something of the relation between soil type and the response to all these treatments, might also be considered here if space permitted. They can be seen fairly well by examining the tables themselves, however, and some of them will be referred to briefly in connection with results that follow.

Results from Mature Orchards.

One of the following orchards can hardly be considered mature, since it is now only 10 years of age, but it is considered in Table IX along with the 24 year old trees of experiment 338 because the experiments are of the same type and they thus admit of briefer treatment. These two experiments, 336 and 338, are what we have called "combination experiments" because they involve two

distinct series of plots—one on fertilizers and the other on cultural methods. Only the latter series is considered in Table IX and the treatments correspond with numbers IV, VII, and X of the general plan shown in Figure I. No fertilization has been used on the present plots except once, in 1911, when a commercial fertilizer analyzing about 6-10-6 was applied uniformly over all the treatments at the rate of about 600 pounds per acre. The results from these two experiments on the four characters of yield, growth, size and color are as follows:

TABLE IX.—INFLUENCE OF CULTURAL METHODS ON YIELD, GROWTH, SIZE AND COLOR IN APPLES.

(Annual yield per acre and total growth increases, 1908-1912, and average size and color, 1909-1912.)

—	Experiment 336.	Experiment 338	Total Yields.	Yield Inc. over Sod.	Inc. in tr-girth.	Growth Inc. over Sod.
	bu.	bu.	bu.	per cent.	in.	per cent.
Covercrop.....	47.8	312.9	1142.0	72.5	8.33	41.4
Mulch	57.0	266.4	1030.2	55.6	7.30	23.9
Sod	23.1	190.2	662.4	.....	5.89	.....

—	Average Size in 336.	Average Size in 338.	Average Size.	Size Inc. over Sod.	Average Color.	Color Inc. over Tillage.
	oz.	oz.	oz.	per cent.	per cent.	per cent.
Covercrop.....	6.77	4.24	5.50	12.0	62.0	.....
Mulch	6.48	4.06	5.27	7.3	69.9	12.7
Sod	6.01	3.82	4.91	.....	74.4	20.0

These results show greater benefits from the tillage and cover crop treatment than any of the experiments thus far considered. In every character except color this treatment here shows very decided gains over sod alone, and with one additional exception, it is also surpassing the mulch by considerable margins. To be more particular, as compared with sod, the cover crop trees are making 41 per cent. better growth, 72 per cent. better yields which amounts to more than 122 bushels per acre annually in experiment 338, and the fruit is 12 per cent. larger. As against this, the sod fruit is 20 per cent. higher in color. Their gains and losses in comparison with the mulched trees are similar, but with smaller differences, and as usual in the younger orchard the mulched trees are again showing the better yields by about 10 bushels per acre annually.

These results are likely to be considered much more "orthodox" than those in the three earlier experiments, because they are more nearly in line with much of the current opinion. The other results are more extensive, however, and are just as truly the responses of the trees concerned. The exact effects and the relative values of cultural methods, therefore, as well as those of fertilization, are apparently very much influenced by local conditions.

As already noted also, it is impossible in the present cases to determine how much of the credit is due to the cover crops and how much to the tillage. In view of the rather unfavorable results from cover crops in the direct comparisons above, however, the present benefits can hardly be largely or positively credited to them without more definite evidence.

Relative Commercial Quality of the Fruit. Assuming that commercial quality in apples is largely dependent on the size and color of the fruit, it would seem to be almost a triple tie between the treatments here, since the gains in size are practically off-set by the losses in color and vice versa. If there is any advantage it is probably with the mulch, as its size seems to be satisfactory and its color is distinctly higher than that of the cover crop fruit. On the same basis and assuming equal soundness and perfection, the mulched fruit in experiments 217-19 would doubtless be ranked first in commercial quality in about two-thirds of the cases, or in about six of the nine opportunities for comparison. The high average size generally shown by the mulched fruit, when the crops are not excessive, is clear evidence of the excellent moisture-conserving ability of a good mulch, and this has also been thoroughly demonstrated experimentally.

Thorough and proper tillage will also conserve the moisture very satisfactorily, but its action on the color of the fruit is very similar to that of too much nitrogenous fertilizer, the result in either case being a gray and unsightly color instead of a rich red, which greatly detracts from its saleable qualities. Other characters, however, such as full development in size, and a normal period of ripening, are also very important in securing the best dessert and keeping qualities, and where the tilled fruit can excel distinctly in these respects, it may often more than overcome its usual deficiencies in color.

The keeping quality in this connection is obviously of sufficient importance to warrant definite and extensive tests of average fruit from the different treatments, but as yet the facilities have not been sufficient to get this accomplished.

Results from the Fassett Orchard.

This orchard is fully mature, since its age as shown in Table I is now 40 years. Its results therefore should be typical of orchards in the fully mature class. Our experiment here was started in 1907, and the treatments involved are those numbered IV to IX in the general plan stated in Figure I. The other treatments in this plan were omitted because of limitations in the experimental area available.

The results of the present treatments in respect to the four characters under consideration are shown in Tables X and XI. The yields are given for four years only, excluding the first two years instead of one in this case, so as to give the same number of full and off years to each treatment. This is desirable in the present experiment because of the marked alternations in bearing in some of the plots, with their full crops not all coming on the same years. The trees are set at the rate of 27 to the acre.

TABLE X.—INFLUENCE OF CULTURAL METHODS ON YIELD AND GROWTH, EXPERIMENT 221.

(Annual yields per acre, 1909-1912, and the average growth, 1907-1912.)

———	Average yields, 4 years.		Growth, 6 years.	
Treatments.	Tillage and Covercrop.	Sod Mulch.	Tillage and Covercrop.	Sod Mulch.
	bus.	bus.	in.	in.
WITHOUT FERTILIZATION	345.9	322.8	5.39	3.19
Gain over mulch	23.1	.....	2.20	.....
Relative gain	7.2%	.....	69.00%	.....
Rank	1	2	1	2
WITH MANUBE	382.5	513.5	6.72	4.26
Gain over lowest	.....	131.0	2.46	.....
Relative gain	.....	34.2%	57.7%	.....
Rank	2	1	1	2
WITH FERTILIZER	372.5	438.9	6.06	4.16
Gain over lowest	.....	66.4	1.90	.....
Relative gain	.....	17.8%	45.6 %	.....
Rank	2	1	1	2

TABLE XI.—INFLUENCE OF CULTURAL METHODS ON SIZE AND COLOR, EXPERIMENT 221.

(Average weights and color of fruit, 1907-1912.)

Experiment 221.	Average Size.		Average color.	
Treatments.	Tillage and Covercrop.	Sod Mulch.	Tillage and Covercrop.	Sod Mulch.
			Per cent.	Per cent.
WITHOUT FERTILIZATION	4.79 oz.	5.22 oz.	68.0	79.9
Gain over covercrop alone	.....	9.%	.....	11.9
Rank	2	1	2	1
WITH MANURE	5.45 oz.	5.33 oz.	65.9	72.6
Gain over covercrop alone	13.8%	11.3%	—2.1	4.6
Rank	1	2	2	1
WITH FERTILIZATION	5.16 oz.	5.37 oz.	68.9	73.1
Gain over covercrop alone	7.7%	12.1%	.9	7.5
Rank	2	1	2	1

Taken as a whole, these results show a rather marked distribution of the honors, neither method showing a uniform superiority over the other on all characters. The mulched fruit as usual is superior in color. It is also ahead in average size in two cases out of three, and its deficiency in the third is so slight that its general superiority in color would probably entitle it to rank first throughout in commercial quality.

On the other hand, we find that here, as in the other mature orchard, the trees receiving the tillage and cover crop treatment are making uniformly the largest growth. Whether or not this is also the best growth for trees of this age is less certain. There are some indications that the two plots receiving fertilization, in addition to the tillage and cover crops, are now making rather too much growth for best results in yield, which is naturally the important item in a mature orchard,

and in it unnecessary growth is objectionable. In the *absence* of fertilization, also, the cover cropped trees are excelling in yield, by about 23 bushels annually, and this margin would be materially increased if the yields for the entire period were included. This superiority is very decidedly reversed, however, when fertilization is added to both treatments. Under the latter conditions, the mulched trees are giving better annual returns than any combination involving tillage and cover crops that we have tested thus far. Their yields, also, have been much steadier than those in the following table, which shows the annual yields from 1907 to 1912, in bushels per plot of about an acre.

TABLE XII.—INFLUENCE OF CULTURAL METHODS WITH FERTILIZATION ON STEADINESS OF YIELD.

(Yields in bushels per acre annually, in Experiment 221.)

Treatment.	1907	1908	1909	1910	1911	1912	Average last 4 years
	bus.	bus.	bus.	bus.	bus.	bus.	bus.
Mulch and manure.....	34	215	493	526	621	413	513.5
Covercrop and manure....	117	145	493	216	612	188	382.5
Mulch and fertilizer	38	199	409	560	370	416	438.9
Covercrop and "	129	122	639	118	573	161	372.9

In the presence of fertilization, the difference here between the mulched and tilled trees in steadiness of yield is very striking. The tilled trees on the one hand are showing a regular and distinct off-year, while those receiving the mulch have shown steady increases in yield up to about 600 bushels per acre, followed by a drop of only about 200 bushels. In the latter trees, the off-year has not yet been eliminated entirely, but its influence has been very greatly reduced. At the present time, the average deficit on the tilled and fertilized trees in this experiment is practically represented by the losses in their off-years.

The fundamental cause of this difference is very important. Practically, it seems that the chief difference in treatment lies in the fact that the tree roots are materially disturbed in one case and not in the other. Strange to say, this disturbance does not seem to have injured the growth, but it, or some other influence not yet recognized, has evidently reduced the yields very materially. The harmful effect on yield of too much pruning of tree tops is now generally accepted, hence may it not be true that similarly harmful effects are associated with any material pruning of the roots?

These and other relatively unfavorable results with the ordinary methods of orchard tillage suggest the advisability of shallower plowing over tree roots—not deeper than four inches at the most—and where conditions permit, it would seem advisable to displace the plow entirely, either with a double-action disc or cutaway harrow, or with a mulch.

IS FERTILIZATION MOST EFFECTIVE ON TILLED OR UNTILLED TREES?

Judging from the Fassett Experiment alone, one would answer this question positively in favor of the latter trees, in Table X for example, the addition of manure to the tillage and cover crop treatment has resulted in a gain of only

37.6 bushels per acre, while the corresponding gain from its addition to the mulch is 190.7 bushels or over 5 times the gain on the tilled trees. With fertilizers, similarly, the gains are 27.6 bushels on the tilled trees and 116.1 bushels on those receiving the mulch. Incidentally, the thinner mulch, under these larger trees, shows none of the interference with fertilization noted in the experiments of Table V.

Similar inferences may be drawn from the large benefits obtained in our untilled fertilizer experiments in the Johnston and Brown orchards,* as compared with those in other experiments involving tillage, though such comparisons are naturally much less direct and exact than those in the Fassett orchard.

In Table V, however, with the exception of manure on sod, we see better average gains in yield from fertilization in connection with tillage, and this is especially marked in experiment 218. In Table VI, similar results are apparent in regard to growth, the most striking gains from fertilization in this case being shown by the tilled trees of experiment 219. The benefits from fertilization, therefore, are by no means confined to untilled trees, and in some cases its utilization is evidently better when accompanied by some cultivation.

The exact conditions associated with these different kinds of response have not yet been determined, and this is one of the questions intended for further study, by chemical and physical means, as soon as the necessary facilities are available.

The Relative Importance of Fertilization.

Throughout these experiments, and especially in the older orchards, the importance of fertilization has been very apparent. In most of the results from Table V on, it will be observed that the addition of fertilization, either in manure or in commercial form, has largely neutralized the differences developed by the various cultural methods when used alone. In some cases also, it has even distinctly reversed these differences. Similar, though not exactly analogous data, bearing on the same general question, may be obtained from the Johnston experiment by comparing the yields produced on its cultural-method plots with those from certain of its plots receiving fertilization.

The figures resulting from this comparison are shown in Table XIII. As already noted in connection with Table IX, the cultural-method plots in this experiment have received one uniform application of fertilizer, the application being made in 1911. It has not yet influenced the yields very materially, with the possible exception of the mulched trees in 1912, but the annual differences for the three preceding years are also given, thus permitting any further comparisons that may be desired. The sod here is not very heavy, owing to the practically complete occupation of the ground by the trees.

*The fertilizer experiments in these orchards are discussed in our bulletins and annual reports on orchard fertilization.

TABLE XIII.—RELATIVE INFLUENCE OF CULTURAL METHODS AND FERTILIZATION ON YIELD.

(Annual yields per acre, during four years, 1908-1912, in Experiment 338.)

Treatment.	An. Yields per acre.	An. Gain over Sod.	An. Gains 3 years, without fertilization of the Cult. Methods.
	bus.	bus.	bus.
Sod	190.2	.....	.....
Sod mulch	266.4	76.2	22.
Tillage and covercrop	312.9	122.7	100.
Sod plus phosphate and potash	277.6	87.4	123.
Sod plus nitrogen and phosphate	542.0	351.8	451.
Sod plus manure	637.0	446.8	390.

In the present table, it will be noted that sod alone has given a 4-year average yield of 190 bushels per acre. The addition of a mulch has raised the average by 76 bushels, and the substitution of tillage and cover crops has rasied it still further, to a gain of nearly 123 bushels per acre, which is the maximum gain obtained thus far in our experiments from the latter combination.

In the latter half of the table, however, we find that the addition of phosphate and potash to sod, without any cultivation, has resulted in an average gain of 87 bushels per acre, while the addition of nitrogen and phosphates has given an increase of about 352 bushels, and manure now shows the enormous gain over sod alone of more than 446 bushels per acre annually. These latter increases are thus about 3 to 4 times as great as the best of those obtained from modifications in cultural methods alone.

These and other results given above indicate that in many cases the character of the fertilization is of greater importance than the particular cultural method followed. This is not always true, however, and before doing any extensive fertilizing of orchards, we always recommend a preliminary local test, on the general plan described in our recent reports and bulletins on this subject. Similarly, before making any radical changes in a cultural method, it is always advisable to give the proposed change a careful trial on a typical portion of the orchard, unless one already has undoubted evidence of the value of the change for his particular conditions.

Q.—It gives better color on your fruit?

PROF. STEWART: Yes, and that brings up another question, the relation of these things to color. I may say that we get regularly more color on the mulch fruit and on the sod fruit. We get more color on sod fruit than any other. After that comes the mulch and after that the tillage, and then tillage and cover crop. Tillage alone and tillage and cover crop run along about together. As to the relative size of the fruit where you use a very definite mulch the mulch fruit has been in general as large if not slightly larger than the other fruit. That also is different from the results obtained by some other experimenters, but that is the result that has been obtained in our experiments.

Q.—What about insect pests?

PROF. STEWART: I have not noticed any material difference in the amount of insect injury in one case than another. That may be due to the fact that they run side by side.

Q.—What about fungus?

PROF. STEWART: I have not noticed any material difference there. It is quite possible you might get a little more fungus and a little more insect injury from the mulch system than the other. In fact it is very probable that that might result, but we have not noticed that in these experiments yet. I may also say that in the case of the mulch you have to give special attention to avoid injury by mice or rats. We have had some trees as much as eight inches in diameter girdled by mice in connection with the mulch system, and also we have had some injured in the tillage system where a little growth was permitted to remain near the trees. If you are going to use the mulch system you must give special protection against the danger of girdling. I may say there is this against the mulch system that it may increase somewhat the danger from fire. It has those objections. The general conclusion that we might draw from this work is that you are not confined to a single cultural method, but you can get along very well either on young trees or old by means of tillage or of tillage and cover crops. You can get along very well with those and with certain things make either one of them more advisable in your section or in your orchard, but there is not any one of them that seems to be first and foremost throughout our experiments.

Q.—What about foliage?

PROF. STEWART: Especially when we add fertilizer we get practically as good foliage on one as the other. Of course sod is the least desirable of any. In fact, it is to be avoided, but if you have got to use sod alone you will find it to your great satisfaction if you can get a manure or proper fertilizer on that land. You can get just as good foliage and as much fruit, and a little better color. That is the result of our experiments. It has simply as I say widened our horizon on the use of cultural methods. I would like to caution you against too deep tillage in case you are tilling your orchard, and perhaps look towards the use of double action discs rather than too much plowing. Of course in some cases if the soil is particularly hard and refractory you may have to plow anyway. The double action disc may not be sufficient, but in that case I should try not to plow more than four inches deep.

MR. ONSLOW: Does the action of cultivation bring the roots very much to the surface?

PROF. STEWART: It has this effect, that there will be very many more roots lower than under tillage, but it is an interesting fact that when you go below that, that is taking an area of six to fifteen inches, that there will be about the same number of roots in that area regardless of the system, and the difference is that in the absence of tillage you have a great number of roots clear on up to the four inches than you do under the tillage system. In other words you have a more abundant root system under the sod than you do in the other case, and it is a strange but true fact in our soils at least that the great majority of feeding roots in apple trees are in the area from about three to ten inches. That is where the vast majority of feeding roots are to be found, and in many cases they are about six inches. That is about where you find them.

MR. ONSLOW: Does the same thing refer to peaches and plums?

PROF. STEWART: To a very large extent, yes. Wherever you have seen the roots of trees exposed by cultivation if you will think it over I think you will recall that the roots of most of our trees are surprisingly shallow and spread out.

Q.—How far?

PROF. STEWART: I have followed apple roots for over forty-six feet on thirty-

five year old Spy trees. Just think about that a minute. We plant a tree say 40 by 40. Now, there were Spy tree roots reaching 46 feet, and in that case the roots would go clear over to the other tree, and six feet beyond, and the other tree would have been sending roots over past it. Many times we plant still closer than that. We consider all the time the question of the crowding of the tree tops as the important thing in setting out trees, whereas as a matter of fact we ought to consider to a considerable extent at least the crowding of the tree roots in those areas.

RESOLUTIONS OF THE FRUIT GROWERS' ASSOCIATION PASSED AT THE CONVENTION, 1912.

Resolved that the members of the Ontario Fruit Growers' Association in Convention assembled desire to express to the Hon. Mr. Duff, Minister of Agriculture for the Province of Ontario, their appreciation of the interest taken by the Department of Agriculture in the fruit growing industry of the Province, more particularly during the past year in the appointment of Mr. L. Caesar as Provincial Entomologist, whose work has already proved of very great value and promises to become of still greater importance.

The appointment of a Market Commission for the western Provinces has also resulted in the placing in the hands of the shippers of the Province of a large amount of information of considerable value. It is hoped that this office will be continued and extended in its scope during the season of 1913.

The continuation of the annual grant to the Exhibition Board has also been very acceptable, and has enabled the Board to instal and maintain an exhibition which is a credit to the Province and a satisfaction to all concerned.

The thanks of this Association are also hereby tendered to the Mayor, Board of Control and members of the City Council of Toronto for the free use of the Horticultural Building during the present week in which to hold the exhibition, also for the increased grant to the Exhibition Board which has enabled them to largely extend the usefulness and scope of the exhibition.

Believing that one of the principal reasons for the comparatively high prices of fruit products to the consumer is the lack of proper markets, etc., we would request that the matter of better market facilities for the disposal and distribution of the large quantities of fruit which is now seeking an outlet in Toronto, receive the serious consideration of the City Council in the near future.

The thanks of this Association are also hereby tendered to the Hon. Mr. Burrell, Minister of Agriculture for Canada, for the great interest he has displayed in regard to improving conditions in the various fruit growing sections of the Dominion, and in largely increasing the staff of inspectors as requested at the last Dominion Fruit Conference. It is hoped that the scope and powers of these inspectors may be considerably enlarged so that they may be enabled to take cognizance of the handling of fruit by the various carrying companies, and, also, of the shipment of unripe and unwholesome fruit to the markets by irresponsible parties.

In the opinion of this Convention of the Fruit Growers' Association of Ontario, it is advisable in the interests of the fruit industry that the Provincial Government take over the appointment of the local inspectors for the eradication of fruit pests

and diseases, and place in these positions men specially trained for the work; and this Association respectfully requests that the Fruit Pests Act be amended in these particulars at the next session of the legislature; copies of this resolution to be forwarded to the Premier and the Minister of Agriculture.

Resolutions of Condolence.

We desire to record our deep regret on account of the death, during the past year, of Prof. John Craig, of Cornell University, a gentleman long and favorably known in connection with horticulture in Canada.

We have also just learned, with sincere sorrow, of the sudden death of Major R. W. Sheppard, of Como, an honored member of our sister Association, the Quebec Pomological Society.

We extend to the families of both these gentlemen our sympathy in their hour of bereavement.

The Chairman: This report is not by any means as full and complete as it was hoped it might have been, but a number of resolutions have been passed in committee and they are now presented to you.

Mr. Onslow: I would move in amendment to the resolution that this Association emphasize their appreciation of the work undertaken by Mr. McIntosh in reference to transportation, etc.

Mr. Thompson: I second that. I would also move a resolution be passed that the Association appreciates very much the kindness of Professor Stewart in coming here to deliver two such interesting and valuable addresses.

Mr. Robertson: May I add in connection with the subject of nursery control that our Committee met yesterday and did not come to any definite conclusion, but recommended that more stringent measures be taken in connection with fumigation, and that it be left to the Committee of those who have to deal with it to see that the boxes are thoroughly fumigated. We talked the thing over, and we have taken that matter into our serious consideration before, and there seems to be no practical method. The nurserymen thought there ought to be some added price to the nursery stock to cover these things as some compensation for their extra trouble. It seems that some of the larger nurseries import some of their stock and they have no guarantee, and they mix it with the Canadian nursery stock and fill their orders. There have been some cases where people have failed in getting the buds from the proper trees. Of course we as fruit growers are the sufferers, and with peaches it is sometimes difficult to get a tree that is true to name. With apples there is a variation in the growth which an experienced eye can locate. It was left at that, but they suggest dealing only with reliable nursery firms. We have failed to come to a conclusion as to what that embraces.

The Chairman: They desire to report progress and ask leave to continue their investigations, but you ask for more stringent control with regard to fumigation?

Mr. Robertson: That is all.

The Chairman: This Committee will have full authority to sit during the coming year and see if they cannot arrive at some conclusion with reference to the control of our nurseries, and arrangements that will be more satisfactory to the fruit grower.

Prof. Crow: I would like to speak in support of Mr. Onslow's resolution. That resolution comes closer to what I had in mind than anything which has been

offered. I have not attended all the sessions of this convention, but so far as I am aware there has been nothing definitely said with regard to the subject of co-operation. I know the subject has been broached two or three times. Now, I venture to make some remarks for the reason that I believe that Co-operation in the handling and selling of our fruit products is not making the progress it should make. I know there are a few districts where co-operative associations are doing excellent work, and in which the co-operation spirit seems to be on a permanent and sound basis, but I believe outside of these few districts the general idea of co-operation is not spreading and is not advancing. At least if it is doing so it is doing so very, very slowly. Now, I should like to see much more interest taken in the general question of co-operation than has been evidenced. I know it is in the minds of the growers, but so far as I know it has not come to the surface at this convention. In my opinion it is time it was made somebody's special business to spread the propaganda of co-operation. I believe the fruit interests of this country require the development of the co-operation idea throughout the country-side, generally speaking. We need it. We have got to have that means of handling our products. Our growers are not learning as much as they should about co-operation. They are not getting posted and they are not taking up the work. I believe it is time we made it somebody's special business to talk the propaganda up and assist in organization. I quite realize that as fruit growers we cannot go to the Government and ask for a grant to be used in the organization of co-operative associations, because we would be considered as encroaching on the realm of the private dealers, and probably not without reason; but at the same time in other countries Governments do make grants to what is called the Organization Fund of Co-operation Societies, and under the organization fund an officer may be employed whose special duty it is to look after the work I have in mind. Now, in the resolution presented a few moments ago it was suggested that the general subjects of transportation, and so on, as handled by Mr. McIntosh be consistently handled by him. It was also suggested in another resolution that a committee be appointed to investigate the general situation with regard to the handling and selling of products. It is my opinion that if the fruit men would get together they would not be very long in finding out exactly what they wanted. I believe we know what we want. I do not know whether it is necessary to appoint a commission, but I believe we do know just about what we want, but the difficulty is when we come to ask for anything we take forty different ways of doing so. If we could work together I think this thing would work out very satisfactorily indeed.

Mr. Smith: I would like to hear Prof. Crow put what he has said in the form of a resolution so that something may be done. To my mind the greatest need of the fruit grower is what Prof. Crow has outlined. I think something done in that line in a practical way will do more than appointing a commission of enquiry such as is suggested. I do not know whether it would be in order or not, but it strikes me by the report presented by Mr. McIntosh that he is just about the kind of man we want to go through the country and preach the gospel of co-operation.

Prof. Crow: I should much prefer not to put that resolution. In my professional capacity I think it would hardly be proper. I should like to see sufficient interest taken in the subject by the fruit growers for that resolution to come from one of them.

Mr. Thompson: It was with a good deal of hesitation that Mr. McIntosh was appointed at first owing to the question of expense. However, they decided to do it, and I am glad that the results have proved satisfactory and that we are all satisfied, and I think possibly if it were left in the hands of the incoming Board that that work should be followed up, coupled with co-operation, so that there would be more active work done during the coming year along those lines than has been in the past. I think perhaps that would cover the point. If necessary we might add to the resolution of Mr. Onslow that the work of Mr. McIntosh should include that. Of course he said it should be continued, and that the work of co-operation be also added to transportation. I would amend it by adding the word co-operation.

Mr. Andrews: It seems to me it might not be a bad plan to appoint a committee to work on this during the coming year. It is a very big subject. There is one idea which I suppose this Association could hardly deal with, but it has always seemed to me the growers should have a wholesale house in all the big cities. How this is to be brought about I do not know. If a committee was appointed they might be able to make some suggestions and some good come out of it.

The Chairman: It was decided to have these standing committees meet in January, and the suggestion of Mr. Andrews will probably have consideration at that time.

The President declared the resolutions passed as amended.

Mr. Onslow: I would like to mention this, that every man coming from a different part of Ontario can help us all greatly by interviewing his own member and making him cognizant of the importance of our Association, so that when this matter comes up in the House he would be anxious to see that we get proper financial assistance.