

Professor Wilson: It is only a question of time that powdered arsenates will be used altogether.

The Chairman: This has been a very excellent discussion. Forasmuch as the next paper by Mr. Winslow has a bearing on the present discussion, I take pleasure in asking Mr. Winslow, Provincial Horticulturist, to present his paper.

THE ECONOMIC SIDE OF PEST-CONTROL.

BY R. M. WINSLOW, PROVINCIAL HORTICULTURIST, VICTORIA, B.C.

I propose to deal with pest-control on fruit-trees and with the economic side of that question, largely in its relation to the question of costs of production. The cost of controlling insects and diseases on fruit-trees is a part of the larger one of total cost. Our present cost of fruit-production, I am safe in saying, is out of proportion not only to the market prices being received for the product, but is further greater than the production costs of our competitors in those markets. It is true that our fruit has a certain percentage from the Customs tariff, and is, in addition, protected in some cases even more heavily than by the tariff, by more advantageous freight and express rates than our competitors enjoy. It is my own conclusion, however, that the advantage given us by lower freight rates and the Customs tariff does not nearly equal the higher cost of production. If, therefore, our competitors were receiving remunerative prices for their product, our prices, though relatively higher, would be actually less remunerative because of our much higher costs. For instance, skilled orchard labour costs us approximately 25 per cent. more than it does in Oregon and Washington. Most of the materials, such as land, nursery stock, spraying materials, tillage, tools and implements, fruit-packages, paper, nails, packing-house equipment, etc., cost us approximately 20 to 40 per cent. more than our competitors. The fruit-grower's cost of living itself is, perhaps, even higher proportionately, while money both on mortgages and on personal loans costs from 10 to 25 per cent. more. The effect of all these differences is to raise the average cost of apple-production, for instance, in bearing orchards in the interior of British Columbia to about 75 cents a box, as against 50 cents for our competitors; in many cases the difference is very much greater.

The big problem of successful fruit-culture is strictly an economic one. We must be able to sell our fruit at a return that represents at least a margin of profit to the producer, and every possible assistance should be given him to that end. Action has been taken to provide a marketing organization which, while it may not be expected to reduce the cost of marketing, is expected to enhance to some degree the selling-price of the fruit, so providing a larger net return to the grower. The cost of actual production is beginning to give many fruit-growers much concern, and many of them are working to reduce their costs as much as they justifiably can.

As Secretary of the British Columbia Fruit-growers' Association and as Provincial Horticulturist, I have had special opportunities to study the costs of fruit-production, and I am aware that much remains to be accomplished in making savings in every operation in the orchard. Our growers are just beginning to study the economics of their work. Many of them started in fruit-growing with the assumption that profits were so great as to make little economies in production unnecessary. It is an economic law that one part of any general business in the world will stand inordinately high costs, and fruit-growing in British Columbia is not likely to prove any exception. The history of fruit-growing in California and in Western Oregon, the first two fruit sections of the Pacific Coast, amply illustrates this.

Among other things, then, the cost of pest-control is a consideration. You may remember that in the literature issued by Government and by those with land for sale it has been said that pests are at a minimum in the Dry Belt, in which the greater part of our orchards are located; the absence of codling-moth, San Jose scale, and apple-scab, the three most injurious orchard pests, as cited, was undoubtedly correct, and by this intending fruit-growers were led to conclude that injuries

from pests would be small and the cost of pest-control correspondingly so. As a matter of fact, I find that pest-control is costing us a great deal.

It has been a matter of considerable difficulty to get anything definite on what our efforts at pest-control are really costing us, and I must ask you to take my figures only as general estimates, which I have made, however, to the best of my ability.

For the Province, expenditures in 1913 are estimated as follows:—

Materials	\$21,170
Application	20,000
25 per cent. of equipment costs	12,500
Total	\$53,670

Sixty per cent. of this, which is for the Interior, equals \$32,202.

The total value of the fruit-crops of the Interior in 1912, about 1,000 cars at an average of \$500 apiece, both of which I think sufficiently high, was \$500,000, and the cost of pest-control was therefore approximately 6.4 of the total value packed. From this total there is about \$250,000, packing and selling charges, to be deducted. The growers thus received \$250,000 for their product, and pest-control, other than fire-blight, costing them \$32,202, took 12.8 per cent. of their returns; this was too much. We may easily understand, then, the great drop in the use of lime-sulphur, the principal item, this year to about 58 per cent. of the 1912 consumption.

There seems considerable evidence that growers feel less confidence in the lime-sulphur spray, finding that it does not act as a tonic to the trees, and that it does not destroy aphis-eggs. Spraying each year with lime-sulphur is evidently declining in popularity. Inspector Darlington writes me that in Wenatchee, where San Jose scale has to be controlled, about 50 per cent. of the orchards get lime-sulphur every year, others once in two, and others once in three years. Non-bearing orchards, he states, are sprayed even less. The tendency there seems to be to restrict spraying almost altogether to bearing trees, neither codling-moth nor San Jose scale being of much consequence until trees begin to fruit. In that district, which much resembles the Okanagan, the spraying is confined almost altogether to bearing trees. For this reason, I consider it proper to charge the great part of the cost of spraying to the fruit produced.

I might note that, coincident with the decrease of 41.7 per cent. in the amount of lime-sulphur used in British Columbia in 1913 from that used in 1912, there is an increase of 24 per cent. in the sales of Black Leaf 40, indicating that growers consider aphis the principal pest, and find control during the growing season most satisfactory.

It is possible that more lime-sulphur has been used than was required for most economical pest-control. Wenatchee used one barrel to 25 acres; British Columbia used one barrel to 20 acres, and they have San Jose scale to control, which we have not. A saving, then, might be effected by more judicious use. Spraying at a loss occurs too commonly, and could be avoided if fruit-growers could be induced to study their trees and their needs, and to reason for themselves on how to care for them economically.

Fruit-growers from time to time raise the question of home manufacture of lime-sulphur. I reported on the subject to several interested parties some time since, one of whom has since taken it up successfully. The report is very short and is as follows:—

“REPORT ON COST OF MANUFACTURING LIME-SULPHUR AT OKANAGAN POINTS.

“*Present Cost when produced on Coast.*—The cost, f.o.b. Victoria, is \$9 per 40-gallon barrel, which weighs 625 lb. approximately. The freight rate in car-load lots to Vernon is 38 per cent. per 100 lb. The freight to Kelowna and Summerland is slightly greater. Freight charges to Vernon are, therefore, about \$2.44 per barrel, making a total cost of, f.o.b. Vernon, \$11.44 per barrel, wholesale rates in car-load lots for cash or short terms.

"To manufacture in Okanagan.—On a small scale manufacturing in single-barrel lots of concentrated spray, the materials required per barrel are as follows: 112 lb. sulphur, 56 lb. lime. The approximate price of sulphur at Victoria is \$28.50 per ton. The freight rate to Vernon on sulphur, car-load lots, in bags, is 67 cents per 100 lb., while the rate on lime in barrels is 33 cents per 100 lb. There is a slight increase to Kelowna, Summerland, and Penticton. The cost of 112 lb. sulphur is \$1.60, freight is 80 cents, total \$2.40; 56 lb. of lime costs approximately 32 cents and the freight costs 16 cents, a total of 48 cents, f.o.b. Vernon. The laid-down cost of materials is, therefore, \$2.88.

"To make up a barrel of spray requires boiling for one hour. Preparation might be estimated at another hour, and there must be a barrel to put the material in. Labour will cost probably 65 cents; a barrel will cost about \$1.25; fuel will cost say 30 cents; total cost, \$2.20. Paying car-load freight rates on materials, total cost will apparently be around \$5.08 per barrel.

"This will not, however, be quite as strong as the commercial product, which tests 32½° Beaume, and the value depends in direct ratio to the Beaume test. Usually it should test about 20° if made under proper conditions.

"If lime and sulphur were brought up to the Okanagan in less than car-load lots, the total cost would be increased to about approximately \$7 per barrel, the L.C.L. rate on sulphur \$1.24, and on lime 74 cents.

"There would be, in addition, the cost of a hydrometer—\$1—and the first cost of the boiling plant, which on a one-barrel scale need not be over \$12, and might be kept as low as \$3 or \$4.

"The local prices of lime and sulphur would probably put the manufacturing of small lots out of the question. There is, in addition, the need for experience and skill in manufacture and in using the Beaume test. The variation in strength of the home-made is an objection."

I learn from Captain Brush, manager of the K.L.O., that he effects a considerable saving by making lime-sulphur on the ranch.

It would seem that, given proper conditions, several dollars per barrel might be saved. On the small scale, especially with inexperience, the saving, however, would be more apparent than real. The O.A.C. bulletin on "Making Commercial Lime-sulphur" is very good and may be followed to advantage. A good report on a successful plant of fairly large capacity is given by Professor Cole in the Washington State Horticultural Society's Report of 1912.

The cost of spraying machinery here is greater than elsewhere, because of a duty of 25 per cent. and long distance from the Eastern manufacturers and consequent high freight charges. We have looked into the question, but fail to find any hope of materially reducing the cost to the purchaser in either tariff or freights. The retailers' margin for handling is small, especially in Vernon, and there is little profit in it for them.

The British Columbia Fruit-growers' Association secures wholesale rates on the principal spraying materials for its members for cash, and the saving effected, by Coast growers principally, amounts to a very considerable sum. They buy about \$3,000 annually through the Association, and save about \$700 by so doing. This price-list has also resulted in retailers generally quoting these materials at small margins, and I do not look for much reduction in cost there.

SUMMARY.

- (1.) Our total cost of production is too high.
- (2.) The cost of pest-control seems excessive considering our comparative freedom from pests.
- (3.) The high cost of pest-control is due, partly, to high cost of machinery, materials, and labour, but there seems little chance of reducing these costs. None of these are providing excessive profits to makers and dealers under present economic conditions.

(4.) The high cost is partly due to sprays applied as preventives against dangers, minor or fancied, and to the general use of lime-sulphur as a tonic and aphiscide.

(5.) Costs will be most easily reduced by more intelligent study of pest-control, leading to greater efficiency of sprays applied, and to omission of control measures not justified by the net results.

(6.) There may be a saving, under favourable circumstances, by making concentrated lime-sulphur at home, and possibly a nicotine spray could be made to advantage from tobacco-waste in the Kelowna district.

Mr. Cunningham: Would you start economy with spraying?

Mr. Winslow: I can't talk economy in packing and the other branches of fruit-production to the Entomological Society.

Mr. Cunningham: Why not? The growers are falling down on spraying. Did not the low prices that prevailed last year raise the percentage of the cost of spraying? When I was in Wenatchee the one point that impressed me the most was the fact that every grower who had six acres of orchard owned a sprayer.

Professor Wilson: Some of our growers in Oregon are spraying too little, some just right, and some are ruining themselves with spraying.

Mr. Cunningham: I do not know one man in this Province who is using too much spray. I recollect an instance where a man lost his entire crop of McIntosh Reds while the majority of the fruit could have been saved by the use of a spray. What was the 25 or 50 cent cost of spraying in comparison to the value of the apples?

Professor Wilson: Let it be understood clearly that I am not arguing against spraying—much the reverse. I can instance a case of one grower who sprayed four times for apple-scab and you never saw a worse proposition after it all. He did not get the spray on at the right time; he was too late with each application. The amount of spray used has no bearing on the results; it must be put on right.

Mr. Taylor (Kelowna): In my opinion, the use of home-boiled mixtures for scab are superior to the commercial brands. It cost us about 10½ cents to spray a tree yielding \$6 worth of fruit. I believe the average grower overestimates the cost of production.

A member: Do not these home-boiled mixtures crystallize before use?

Mr. Taylor: They had better be put on fresh and warm.

Professor Wilson: In regard to crystallization of home-made products, we find that this does not affect the spray in any way. The crystals can be dissolved out in cold water and then used.

Mr. Winslow: If we can control our pests for half the money, will not the other half be saved?

Mr. Cunningham: I do not think the possibility has been shown.

Mr. Treherne: I usually prefer to figure out in a general way the average cost of production of an infected crop and the average yield of that crop to the ordinary grower, and then after allowing a fair interest as returns, about 8 per cent., the difference gives me an approximate idea as to how much may be spent to apply a remedy. This method is not safe, however, if there is danger of losing the tree on which the crop is being grown, and this brings up the question of tree, bush, or annual crops. The personal equation is another important point, for we find a great variation in the business abilities of individuals, and each one can only apply that amount of remedy suited to his pocket, to obtain the best results, economically and practically. I would suggest, however, that the discussion be confined to the point where we can advise the grower what sprays to use on his crops one year with another, or, in other words, what annual sprays are necessary.

Mr. Brittain: There are difficulties in the way of doing this, as conditions change so materially from year to year with different localities. A Vernon grower could not be expected to spray for a pest in Penticton. It is a local problem. Last

year we had an outbreak of cutworms; this year there are very few. It is usually conceded, however, that a spring and fall spraying are necessities for our condition.

Mr. Cunningham: Can we raise first-class marketable fruit without spraying? If so, where? I don't know. If we are going to compete on the markets, we have to get busy and raise first-class fruit, and this can only be done by spraying. I consider it would be a most unfortunate thing if it gets abroad that the growers are spraying too much. Some men near Vernon have not sprayed for two years. How are they getting along? Are they to remain growing unmarketable fruit? No; get them the machinery and teach them how to spray.

Mr. Taylor: I rather criticize Mr. Winslow if he claims we do not need to spray non-bearing trees.

Mr. Winslow: It is not a question of spraying *versus* non-spraying. It would be most unfortunate if the idea got abroad that I am advocating a cessation of spray application. What I do claim is that a lot of spraying has been misdirected and with consequent discouragement, and how best to find the economic basis.

Mr. Brittain: I think the difference of opinion has arisen from the different view-points taken. I think we can all now gauge the situation.

Mr. Winslow: Lime-sulphur may be made with economy in the valley.

Mr. Taylor: It isn't every one who can make lime-sulphur. The great difficulty is experienced in the resulting varying strength, a variation of 19 to 30 degrees. Another difficulty is the question of the employment of a licensed engineer for small plants.

Professor Wilson: At Corvallis we can make lime-sulphur for \$3.75, the retail price being \$8.10. It is thus useless paying freight on water.

The Chairman: I think perhaps we had better terminate this excellent discussion, as time is getting on. I am afraid we had better proceed. I will now ask our Secretary, Mr. Treherne, to present his paper.

METHODS OF TAKING INSECT RECORDS IN THE FIELD.

BY R. C. TREHERNE.

In preparing this paper, I had in mind the requirements of the field inspectors working in the various orchards, farms, and nurseries in the Province, with the intention of presenting to them certain ideas in estimating the approximate prevalence of an insect pest and its corresponding injuriousness, so that we may be able to obtain a definite and co-ordinated idea on the nature of our local insect pests one year with another.

In order to determine the present rate of an infestation by any insect pest or fungous disease for comparison with an infestation in past or future seasons or periods, or in order to determine the rate at which an infestation increases in different territories with relation, as well, to dates of migration, emergence, or injuriousness, it is desirable that a definite system of recording the prevalence of an insect pest, one year with another, be employed.

I do not claim originality, altogether, for my suggestions that follow, for, after all, the problems of simple arithmetic are the only ones involved, neither do I wish to force those who are working in the field as inspectors to adopt the systems I propose, but personally I prefer to work with a system when in the field, and the following which I am putting forward as suggestions have been useful.

TO DETERMINE PERCENTAGE OF INFESTATION; INJURY OBSERVED.

Select five typical locations in the field to be examined. At each of these five locations select a typical row, tree, or plant to be inspected. Emphasis should be laid upon the word "typical," no partiality or impartiality being shown in the selection. When this is done, count fifty plants, buds, fruit, or leaves, as desired, and examine carefully for injury. Then *the total number of injurious marks divided by the total number of objects examined, multiplied by 100, gives the percentage of*