SPRAY EXPERIMENTS.

Under this heading a good deal of work has been carried out in the laboratory; through collaboration with the Horticulture Division through Mr. Dallas a considerable amount of extension work has also been carried out in the field.

(A) For clearness the subject-matter is dealt with under the headings—(*a*) Winter Oils; (*b*) Summer Oils.

(*a*) *Winter Oils.*—This included the testing of various oils as ovicides for red mite eggs under laboratory conditions. In this connection the following oils were used for dormant spraying at strengths of (1–15) and (1–20): Shell Red, Restar, Carbocraven, Avon Miscible, Sprayol, Avon Spray Emulsion, Winter Solol, Texide, Gargoyle.

(B) All of the laboratory experiments on these oils at the strength stated gave negative results—*i.e.*, none of the oils stated gave sufficiently high control to warrant their recommendation for use as ovicides against the red-mite winter eggs.

These preliminary laboratory experiments are being considerably extended during the coming year, as the work so far is proving a reliable index regarding the efficiency of the use of oils in the field. One of the great difficulties in the use of oils is to obtain reliable chemical and/or physical data by which they may be specified. The information gleaned from the experiments so far conducted, however, are helping one better to understand the relative values of the different physical properties of oils. Preliminary results indicate that within certain limits viscosity is one of the main determining factors regarding ovicidal value. An oil with a viscosity of 127, for instance, has far greater ovicidal properties than an oil with a viscosity of 59. The former giving a 60 per cent. control of mite-eggs and the latter only 25 per cent. control. Where the viscosity drops to 31 the control of eggs only amounts to 10 per cent. Heat of bromination* so far as winter oils are concerned appears to be of little consequence.

As the work so far conducted is merely preliminary, a considerable amount of further experimental work is necessary before any thoroughly reliable index can be obtained.

(b) Summer Oils.—With reference to the use of oils for summer spraying a good deal of useful information has been gleaned from laboratory work. In the past a considerable amount of uncertainty existed regarding the use of summer oils as opposed to lime-sulphur for the control of mites. The experiments indicate that the failure of lime-sulphur compared with oils as a control for mites is that the former, while it is a good acaracide, has no ovicidal properties, whereas the oils are both acaracides and ovicides. Lime-sulphur has been tested against summer mite-eggs at strengths from 1–40 to 1–120. At none of these strengths did it prove to have any ovicidal effect. Summer oils, on the contrary, at 1–80 gave up to 100 per cent. control. A winter oil at 1–150 gave up to 90 per cent. control. In general, however, it is not advisable to use a winter oil for summer spraying, as, apart from the acaricidal or ovicidal properties of the oil, a point of great importance is its effect on the tree or foliage. It appears to be well established that where the heat of bromination is high severe injury to foliage is likely to occur. It follows, therefore, that oils for summer use should have a very low heat of bromination.

Another point of great interest in the use of summer oils is their miscibility with other sprays that must be applied. One of the greatest difficulties is to obtain an oil suitable to apply with, or immediately following the use of lime-sulphur, as burning of the fruit or foliage may occur when these two sprays are mixed or applied within a short time of each other. Apparently the harmful property is not so much the oil as the emulsifier in the oil.

Study of Acid Lead Arsenate, Basic Lead Arsenate, and Calcium Arsenate.

This is an examination of the three types of commercial arsenates on the market in New Zealand. The work up to the present has been of a preliminary nature, and is directed towards discovering which is the most efficient and economical spray for chewing-insects. The materials are being tested for relative poisoning-effects and sticking and covering powers. Experiments have been conducted both in the laboratory and in the field. In the laboratory tests have been confined so far to relative poisoning-effects of several series of equal quantities of acid lead arsenate, basic lead arsenate, and calcium arsenate, the poisons being three commercial brands which are being used exclusively in this work. The amounts of spray used are being correlated with those commonly applied in the orchard, to discover what is the minimum effective dose for various chewing-pests, and whether they can be improved by the addition of spreaders and stickers. The insects being used are the bronze beetle, *Eucolaspis brunneus*, leaf-rolling caterpillars (family Toatricidæ), codlin-moth (*Laspeyresia pomonella*), the tomato and potato leaf-looping caterpillar (*Plusia chalcites*), and the white butterfly (*Pieris rapæ*).

Tests with the bronze beetle show that it should be quite possible to control this pest using the usual quantities of arsenate employed in common orchard practice, provided that the poison can be made to adhere evenly to the fruit. Apples dipped into a spray made by adding 2 lb. of acid lead arsenate plus 1 lb. of casein sticker and spreader to 100 gallons of water, for a minute or two until an even cover was obtained were uninjured by the beetles, whereas apples dipped for the same length of time into a spray made by adding 4 lb. of acid lead arsenate alone to 100 gallons were badly damaged. In the latter case the spray cover was very patchy and the insects had selected unpoisoned areas on the fruit for feeding. This shows clearly that in ordinary orchard practice plenty of arsenate is being sprayed on to the trees to kill the bronze beetle, but that owing to the bloom on the fruit the poison does not give an even cover. Ordinary emulsified mineral oils are natural spreaders and give a much better cover on fruit than do the arsenates alone. Experiments have also shown that oils repel the bronze beetle and the most hopeful line of attack on this pest is to find an oil which will combine satisfactorily with the arsenate and give an even cover on the fruit. Experiments on these lines will soon be continued.

The leaf-rolling caterpillars commonly found in the orchard are other pests which are difficult to control.

The supply of these caterpillars for laboratory experiments was very limited, and so the experiments conducted were on a small scale only. The tests have shown, however, that the action of the arsenates is much slower on these caterpillars than they are on the bronze beetle. Although these experiments were not very conclusive on account of the small numbers of caterpillars available, and on account of high mortality in the controls and a very large amount of parasitism in some of the series they indicate that enough poison is applied in ordinary orchard practice to kill leaf-rollers if they come in contact with it. Control would appear to be in applying the right numbers of spray at the right times. A study of the life and seasonal histories is thus important.

* Heat of bromination refers to the degree of refinement of an oil.