REPORTS

THE WESTERN COOPERATIVE OIL SPRAY PROJECT (1929)

INTRODUCTION

OIL sprays have been used as insecticides for a number of years. However, the selection and preparation of early oil sprays were not standardized. In consequence of variable results obtained in commercial and experimental use, oil spray applications were attended with considerable risk and with marked uncertainty of effect. A meeting of entomologists and chemists was held at Tacoma, Washington, in June, 1926, to consider the variables encountered in connection with the use of oil sprays and to formulate plans for a concerted and coordinated attack on the problem. At this time an organization known as the Western Cooperative Oil Spray Project was formed.

At first, only entomologists and chemists participated in the project, bringing about a close cooperation between the agricultural experiment stations of California, Idaho, Montana, Oregon, Washington and British Columbia, and the U. S. Department of Agriculture. However, since a thorough study of oil sprays could not be made unless the effects of oils in plant tissue were also considered, the scope of the project was later enlarged to include horticulturists and plant physiologists.

Annual meetings are held for discussion of results and to formulate definite plans for further experimental work. This work has now been in progress for four years, and it is the purpose of this article to summarize the more important results obtained. A preliminary report was published in SCIENCE.[1]

This year (1929), representatives of oil refiners, spray manufacturers and other commercial concerns interested were called in conference immediately following the annual meeting. The results of experimental work with oils were discussed, and the commercial interests unanimously agreed to cooperate with the experiment stations by making their products and recommendations conform to the findings of investigational work. It is believed that a marked benefit will result from this cooperation.

DORMANT OIL SPRAYS

Oils for dormant use have repeatedly demonstrated their value as a spray treatment for San José scale, orchard leaf-roller, red spider, tree-hoppers, etc. It has been found that a lubricating type of oil with a viscosity range of 100 to 220 seconds Saybolt is satisfactory for dormant use. High refinement of oils for dormant use is not necessary since those with a sulfonation test of from 50 to 85 have proved safe when properly emulsified and applied.

The emulsifier used in oils during this period is an important factor from the standpoint of plant injury. While the emulsifier in itself has no injurious effects, the size of the dispersed oil droplets and the stability of the emulsion produced by the emulsifier influence the amount of oil that is deposited and retained on the plant. Quick-breaking emulsions have been found to cause severe injury to trees if applied during a critical period of bud development. This period may be said to exist from the time the buds first show green until the cluster buds separate. While quick-breaking emulsions have given better control of insects in laboratory tests, these differences have not been evident generally in field tests. Therefore, it has been suggested to manufacturers that more stable emulsions be placed on the market.

The time of application of oil was found to be a most important factor. All the oil sprays tested were used with apparent safety if applied before the bud scales separate, even when applied as early as January 15 and when sub-zero weather was encountered following application. However, considerable injury followed the application of quick-breaking emulsions and slight injury from the use of stable emulsions if the application was made during the critical period mentioned above. This is particularly true of trees of the winesap variety or of trees of low vitality.

SUMMER OIL SPRAY

Highly refined oils for summer sprays have proved to be very effective in the control of such insects as red spiders, newly hatched scale, etc. Oil sprays in combination with lead arsenate have also given improved control of the codling-moth. In this combination the oil has a definite ovicidal value while at the same time it increases the larvicidal value of the lead arsenate. Oils in combination with nicotine sulphate have also proved effective in controlling codling-moth, red spider, aphis, etc.

Oils have been studied with respect to volatility (either from the standpoint of evaporation or from the distillation ranges), viscosity and degree of refining or unsulfonatable residue. One property is often conditioned or determined by another so that they can not be varied independently and it is difficult to arrive at a valuation of their effects separately.

In the oils used, the viscosity range varied from 50 to 120 seconds Saybolt. Toxicity for insects within this range was found to increase with viscosity. At a viscosity of 50 seconds oils were relatively ineffective against red spider and codling-moth unless the concentration of the spray was increased consid-

[1] SCIENCE, 67 (1744): 560–561, June 1, 1928.

erably. On the other hand, injury to plants was found to increase with an increase in viscosity of oils above 70 seconds. It becomes necessary, therefore, to select an oil with an intermediate viscosity. It has been found that oils having a viscosity range of 65 to 75 seconds are generally satisfactory when used in a limited number of applications, although certain apple varieties (such as the yellow Newtown) are susceptible to injury from oils with viscosity above 55 seconds.

The degree of refinement of the oils was found to be another important factor in avoiding injury to plants, although even the most highly refined types sometimes produced injury. Whether this injury is due to oxidation of the oil or to the inability of the plants to tolerate absorbed oil of medium to heavy viscosity within its tissues has not been definitely determined. It has, however, been determined that the carbohydrate metabolism of leaves and vegetative spurs may be adversely affected by oil sprays.

With oils refined by the sulphuric acid method, it has been found that those having an unsulfonatable residue of 85 per cent. or more are preferable for use on plants during the growing period. At the present time it appears that oils produced under the liquid sulphur dioxide process of refinement have a greater stability against later oxidation and may therefore have a greater range of safety when applied to living plants. However, further tests are necessary definitely to determine this point.

The type of dispersion of oils in emulsions used during the growing season has not been found to be important where high pressure is used in spraying. This is probably due to the modification in the emulsions produced by the high pressure through the spray guns, reducing the oil droplet size in the less stable emulsions. This probably accounts for the fact that field tests during the last three years have shown but little difference in the insecticidal value of quick-breaking and stable emulsions. Such differences, however, were found in laboratory tests when the oil emulsions were sprayed with atomizers or equipment using low pressure.

Plant injury from summer oil sprays has followed repeated applications of oils having a viscosity range of 70 to 120 seconds. This has resulted in a russeting of the fruit in many cases and in a general reduction in the size of the fruit. It was found that not over two or three applications of such oil sprays could be used if serious damage of this nature is to be avoided.

It has also been found that serious foliage and fruit injury and dropping occurs when oil sprays are applied on trees carrying unoxidated sulphur deposits. The period that must elapse after use of sulphur sprays or dusts before oil sprays can be safely used varies with weather conditions. In hot weather, it is relatively short, but in cool weather it may be as long as sixty days. The Stayman winesap apple is especially subject to this type of injury, but all varieties are affected when it is necessary to use sulphur for fungicidal purposes.

The use of oil sprays late in the summer while heavy deposits of lead arsenate remain on the fruit or the use of medium or heavy oils in combination with lead arsenate late in the summer was found to complicate seriously the problem of spray residue removal. In some cases it has been impossible to clean such fruit satisfactorily. However, where not more than two applications of oil spray are made in combination with lead arsenate for the first brood of codling-moth or where the nicotine-oil combination without lead arsenate is used for the second brood of codling-moth, the arsenical residue problem has not been seriously complicated.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

SEDIMENTATION TUBE FOR MECHANICAL ANALYSES[1]

IN making mechanical analyses of sediments, the dispersal of the constituents is commonly facilitated by shaking with water in bottles for several hours, and the sands are usually separated from the silts and clays by a series of decantations. In these processes, especially if the sample be sandy, it is a time-consuming operation to remove all the sand from the containers in which the sediments were dispersed and decanted. In our work the procedure has been facilitated by dispersing the sediments in glass tubes closed at both ends by rubber stoppers, and by decanting from a sedimentation tube, shown in the accompanying figure.

[1] This paper contains preliminary results of an investigation on the "Origin and Environment of Source Sediments," listed as Project 4 of American Petroleum Institute Research. Financial assistance in this work has been received from a research fund of the American Petroleum Institute donated by Mr. John D. Rockefeller. This fund is being administered by the institute with the cooperation of the central petroleum committee of the National Research Council. Manuscript received by the editor December 17, 1929.