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* Riverhead, N. Y.
BULLETIN No. 281.
COMMERCIAL MISCELLANEOUS OILS FOR TREATMENT OF THE SAN JOSE SCALE.

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SUMMARY.

This bulletin contains the details of a number of experiments with commercial miscible oils to determine their merits for the control of the scale. This work was conducted in three orchards in which 1368 trees were sprayed with these preparations in varying proportions. On the basis of these tests the following conclusions are drawn:

Applications of proprietary miscible oils at the rate of one part of oil to twenty or twenty-five parts of water failed to give uniform results on scale. Trees receiving these treatments usually showed more or less spotting of the fruit and varying infestation of the new growth:

Miscible oils in the proportion of one part of oil to ten or fifteen parts of water, while uniformly more destructive to the scale than the weaker preparations, were usually not quite so efficient as the boiled lime-sulphur wash. These stronger applications destroyed large percentages of the scales, being sufficiently effective to maintain the thriftiness of the trees and to keep the fruit crop fairly clean. On the basis of these results even the better ones of the miscible oils tested should not be used in weaker mixtures than one part to ten or fifteen parts of water.

The miscible oils are commercial insecticides and
therefore the orchardist should understand that the reliability of the stock material rests with the compounder. These sprays are simple to prepare for use, and are convenient preparations for the treatment of odd trees and small orchards. The cost of the miscible oils in the proportions of one part to ten or fifteen parts of water makes their use almost prohibitive for commercial orchardists who desire a safe and comparatively cheap oil spray. Compounders of commercial insecticides should endeavor to produce a reliable miscible oil that is cheaper than present brands.
COMMERCIAL MISCELLABLE OILS FOR TREATMENT OF THE SAN JOSE SCALE.

Crude and refined oils are among the most penetrating and destructive of the contact insecticides, but as ordinarily employed for spraying purposes they must be used with much caution to prevent the applications from injuring the plant while destroying the insect. Rather than run the risks of injuries to his trees the average fruit-grower has largely avoided clear oils for orchard treatment. For these reasons a safer method for the use of oils in this capacity has long been desired. To meet this demand there have appeared upon the market in recent years a number of sprays which have been designated Miscible Oils or Water-Soluble Oils. These preparations have proprietary names and are known as Kil-o-Scale, Scalecide, Target Brand Scale Destroyer, Surekill, Water-Soluble Petroleum, etc. The important ingredients in the more efficient of these commercial insecticides are oils which have been combined with some emulsifying agent to facilitate a uniform dilution with water. In these emulsion preparations, oils are usually rendered safer for the treatment of trees while retaining much of their destructive properties upon insect life.

The commercial miscible oils are concentrated liquids and cost from 50 cents to $1.25 per gallon, depending on the quantity purchased. The preparation of the mixture for use is simple. The directions on the container usually advise the operator to dilute with water using one gallon of the miscible oil to twenty or twenty-five gallons of water, and then to stir until an even distribution of the ingredients is secured. The prepared spray usually contains no sediment and there is ordinarily no clogging of the nozzles.
EXPERIMENTS WITH MISCIBLE OILS.

Following the general plan adopted by the Station in conducting tests of spraying mixtures for the control of the scale, separate blocks of apple, peach, pear and plum trees were selected for treatment. All the trees were thrifty, and, while they were not usually incrusted, the scales were plainly visible upon the bark. In each of the plats applications of miscible oils were made according to the printed directions, using various strengths; and, for the purpose of determining the comparative merits of the respective spraying mixtures, the rows immediately adjacent to trees receiving the oil treatment were sprayed with the kerosene-limoid mixture and the sulphur washes. The miscible oils used in these tests were Scalecide, Kil-o-Scale and Surekill. All the trees were sprayed once and as soon as they were dry were treated again for the purpose of thoroughly covering the parts imperfectly coated by the first application. These tests were made in seven orchards. This bulletin contains the details of the work in three of the orchards which are fairly representative and which are sufficient to indicate the trend of the results of the experiments. The number of trees in these three orchards sprayed with miscible oils is 1368, divided as follows: Orchard I, 43 trees; Orchard II, 46 trees; and Orchard III, 1279 trees.

DETAILS AND RESULTS OF EXPERIMENTS.

ORTHARD I.

In this orchard 33 plums of ten years of age and 10 apples of twenty-three years of age were sprayed with Scalecide or Kil-o-Scale at the rate of one part of miscible oil to either fifteen or twenty parts of water. The applications were made December 13, 1905. All trees, especially the apples, were well infested with the scale. Blossoming commenced May 4 and continued till May 16. A number of trees did not blossom. This, it is
thought, was not attributable to the treatment. With this excep-
tion the appearance of the trees was normal.

Results on scale: Plums.—On June 17, 1906, active young scale
insects were detected on all trees with the exception of the plums
sprayed with the sulphur washes. The breeding of the scale
continued throughout the summer; and by fall the worst infested
trees that had received treatment with Scalecide and Kil-o-Scale
had more scales than in the previous year. On the moderately
infested trees the results with the miscible oil compared favorably
with those obtained by the sulphur washes.

Apples.—On May 4 an examination of a number of branches
showed that about one-half of the scales were alive on trees
sprayed with Scalecide and Kil-o-Scale, the applications of these
oils proving much less effective on apples than on plums. There
was also some spotting of the fruit by the scale on the trees
sprayed with the sulphur washes but the blemishes were much less
abundant and less conspicuous than on the apples from the trees
sprayed with the miscible oils. Two of the trees sprayed with Scale-
cide were so badly injured by the scale that the owner cut them
down in the fall of 1906.

ORCHARD II.

In this orchard 14 apple trees of twelve years of age, 24 plum
trees of eight years of age, 6 peach trees of five years of age, and
2 cherry trees of five years of age, were sprayed with either Kil-
o-Scale, Scalecide or Surekill, using one part of the miscible oil
to either fifteen, twenty or twenty-five parts of water. The
applications were made on April 23, 1906. Every tree in this
block was well infested and occasionally one was much incrusted.

Results on scale.—On May 3 blossoming commenced which was
normal for all trees with the exception of two plums and six
peaches which showed much retardation of the fruit and leaf
buds by the miscible oils. Three of the injured peaches died dur-
ing the early summer. On June 22, a few young scales were
found on plums sprayed with one part Scalecide to twenty parts
of water. Two peaches that were much incrusted with the scale
in 1905 showed, as a result of the treatment with Scalecide at the
rate of one part to fifteen parts of water, hardly any evidences of larval activity. During the summer these two trees produced much new growth which was free of scale throughout the season. All the apples, peaches and cherries sprayed with Scalecide at the rate of one part to twenty parts of water were so badly infested that resort had to be made to summer spraying to save the trees. Kil-o-Scale at the strength of one part to fifteen parts of water practically destroyed the scale, as there was very little evidence, even late in the fall, of larval activity. Preparations of Kil-o-Scale in the proportions of one part to twenty of water killed a large percentage of the scales. This enabled the trees to make a good growth, and they showed only a slight amount of infestation. Surekill was less effective in this experiment than either Scalecide or Kil-o-Scale, and applications of Surekill at rates of one part to either twenty or twenty-five parts of water had no appreciable effects upon the scale, as the trees sprayed with this preparation were, at the end of the summer, as badly infested as the checks.

ORCHARD III.

In this experiment 447 apple trees of five to eight years of age, 384 pear trees of seven years of age, and 448 peach trees of five years of age, making a total of 1,279 trees, were sprayed with Scalecide during April, 1906. This spray was used at two strengths. One lot of 416 trees, including the three kinds of fruit, was sprayed with one part of the miscible oil diluted with ten parts of water and another lot of 863 trees was treated at the recommended strength of one part of the oil to twenty parts of water. The orchards were especially adapted for the purpose, as the trees have been given good care, and were thrifty and small in size. In the past, the owner has used clear oils, mechanical oil-emulsions, kerosene-lime wash and a small quantity of the sulphur wash to control the scale. This pest has been present in the orchards for about six years. The infestation varied with the individual trees but there was hardly a tree that did not have a good sprinkling of the scale, and many trees in each row showed more or less incrustation. In this experiment the rows
immediately adjacent to a row treated with Scalecide were sprayed with kerosene-lime wash (15 per ct. or 30 per ct. oil) and the boiled lime-sulphur wash. In each block of the different kinds of fruit, one row was left unsprayed as a check.

Results on scale.—Many scales were not affected by the treatment with Scalecide, using one part diluted with twenty parts of water. Early in June active larvae were abundant on trees receiving this treatment. An examination of the orchards on Aug. 15 showed that the trees, especially the apples, were but very little better, on the average, with respect to the scale than the checks. Many pears, and some apples, were too much spotted with scale to grade as firsts. Similar conditions with respect to scale existed on a large part of the trees sprayed with kerosene-lime wash containing 15 per ct. of oil. The applications of Scalecide containing one part to ten parts of water showed some variation in their effects upon scale. Some of the treatments were quite as effective as the sulphur washes, while others were noticeably less efficient. There was hardly a tree that did not show more or less living scale at the base of the new growth. Likewise there was more or less spotting of the fruit, especially of the pears, but on the whole, the scale was sufficiently controlled by the 10 per ct. miscible oil to maintain the thriftiness of the trees and to insure the production of fairly clean fruit. The trees sprayed with the sulphur washes, while showing more or less evidence of living scales, had their new growth more uniformly free of scale and the fruit comparatively clean. The results on fruits were especially marked in the case of the pears, for the sulphur-treated trees produced a remarkably clean crop while the yield from the trees sprayed with 10 per ct. miscible oil showed more or less spotting by the scale.

SUMMARY OF RESULTS.

Fall applications of Scalecide and Kil-o-Scale in the proportions of one part to either fifteen or twenty parts of water caused no appreciable injuries to fruit or leaf buds. The effectiveness of these preparations upon the scales was variable. On the
moderately infested plum trees the numbers of the scales destroyed by the sprays in these proportions compared favorably with the results obtained by the sulphur washes, while badly infested plum and apple trees received very little benefit by similar applications of the commercial preparations. In the tests conducted in the spring, applications of one part of Scalecide to twenty parts of water usually failed to control the scales, but when this spray was used in stronger mixtures, of one part to either ten or fifteen parts of water, the new growth and fruit of the trees were kept quite clean. One application of a sulphur wash was usually more effective than one application of a miscible oil in either of these proportions. In one test Kil-o-Scale at the rate of one part to twenty parts of water proved more effective than a mixture of Scalecide in the same proportions, but on the whole there was very little difference in the relative effectiveness of these sprays when the amount of dilution was the same. Surekill applied as recommended had no appreciable effects upon the scales.

CONCLUSIONS.

Applications of proprietary miscible oils at the rate of one part of oil to twenty or twenty-five parts of water, as recommended in the printed directions, did not give uniform results on the scale. Trees sprayed with these strengths in the fall or in the spring usually showed more or less spotting of the fruit and varying infestation of the new growth. Ordinarily not enough scale was destroyed by the miscible oils, in these proportions, to warrant a fruit-grower taking chances on the trees, unless supplementary summer or fall treatments are to be made. The treatments were usually much more effective on trees that were slightly infested than on those showing incrustation of the scale. Surekill was the least efficient of the miscible oils that were tested.

Applications of a miscible oil in the spring at the rate of one part of oil to ten or fifteen parts water, while uniformly more destructive to the scale than the weaker preparations, were usually not quite so effective as the sulphur washes. Preparations of miscible oils in these proportions killed enough of the scale to maintain the vigor of the trees and to secure fairly clean fruit yields.
DIRECTIONS FOR USING MISCELLANEOUS OILS.

On the basis of these experiments it is evident that the miscible oils tested must be used stronger than is recommended by their compounders to obtain satisfactory results on the scale. Therefore instead of using one part of oil to twenty or twenty-five parts of water the orchardist is advised to use at least one part of the miscible oil to ten or fifteen parts of water. Before measuring out the required quantity from its container, vigorously stir or shake the miscible oil to secure a thorough distribution of its ingredients. The failure to follow the directions in this respect is undoubtedly responsible for some of the poor results with these preparations. Before making applications, the oil and water should be well mixed by the spraying agitator. Spray in the spring as the buds are swelling, during a period of clear weather when the trees are dry. The applications must be thorough so that all parts of the trees are completely wet with the spray. If the base of the new growth should during the summer show quite a little infestation, then spray again in the fall as soon as the majority of the leaves have fallen. Spraying in the fall, especially of peaches and plums, is usually not advisable because of the risks of injury to fruit buds. But rather than run the chances of the continuation of injuries by the late breeding of the scale or the neglect of the treatment in the spring, fall spraying is advised, as the increased vigor and usefulness of the trees arising from the control of the scale will more than compensate for probable losses in fruit yields.

The miscible oils are commercial insecticides and therefore the orchardist should understand that the reliability of the preparations rests solely with the compounder. These sprays are simple to prepare and they are discharged from the nozzle as an even mist, as there is usually no sediment or clogging of the nozzle apertures. At a price of fifty cents a gallon for the stock material, miscible oil in the proportions of one part to ten parts of water will cost about $2.50 per barrel of fifty gallons which is
about five times the cost of the raw materials for making one barrel of a sulphur wash. Because of the ease in which they may be prepared for use, they are convenient sprays for the treatment of a few trees and of small orchards. The cost of the miscible oils in the proportions of one part to ten or fifteen parts of water makes their use almost prohibitive for commercial orchardists who desire a safe and comparatively cheap oil spray. Compounders of commercial insecticides should endeavor to produce a reliable miscible oil that is cheaper than present brands, as there is demand for an efficient and economical spray that may be prepared for use with greater ease than some of the present remedies.