SPRAYING FOR THE SAN JOSE SCALE WITH THE LIME-SULPHUR-SALT AND OTHER WASHES.

F. H. HALL, V. H. LOWE AND P. J. PARROTT.

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*Connected with Fertilizer Control.
†Absent on leave.
SPRAYING FOR THE SĀN JOSÉ SCALE WITH THE LIME-SULPHUR-SALT AND OTHER WASHES.

F. H. HALL.

The lime-sulphur-salt wash has been successfully used for many years in California as a remedy for the San José scale. The early experiments with it here in the East, however, were not successful, and it was given up as not adapted to eastern climatic conditions. There seemed to be no doubt about its killing the scales if two or three weeks of dry weather followed the application;—but the experimenters concluded that if hard rains should come, which is apt to be the case during the spraying seasons, it would be washed off at once and leave the scales uninjured. This conclusion was accepted as final until within the past two years when other and more promising experiments were made, especially in Illinois, Georgia and New Jersey. The results of these and other recent tests were so promising that orchardists began to feel that they had a new and important remedy for their much dreaded pest, the San José scale. But the wash had not been on trial in the East long enough to demonstrate what could be expected of it, and hence with the hope that useful information bearing on this point might be obtained, a somewhat exten-

* This is a brief review of Bulletin No. 228 of this Station on San José Scale Investigations, IV, by V. H. Lowe and P. J. Parrott. Anyone especially interested in the detailed account of the investigations will be furnished on application, with a copy of the complete bulletin. The names of those who so request will be placed on the Station mailing list to receive future bulletins, popular or complete as desired. Bulletins are issued at irregular intervals as investigations are completed, not monthly.
sive series of experiments was planned and carried out by the Station during the past season. Before we give an account of the experiments, however, it will be of interest to note the character of this wash and how it is made and applied.

**How made and character of the wash.** A number of formulae for making this wash have been published but the one that gave the best results in our experience is as follows:

- **Lime, unslaked** ........................................... 40 pounds
- **Sulphur, ground** ........................................... 20 "
- **Salt** ......................................................... 15 "
- **Water** ....................................................... 60 gallons

Slake the lime carefully until a good quality of milk of lime is secured. Then pour into the receptacle in which the mixture is to be boiled. Mix the sulphur with water to form a thin paste, and add it, together with the salt and about 30 gallons of water, to the lime. The whole should now be boiled vigorously for from one and one-half to two hours when enough water should be added to make the full sixty gallons and the boiling continued for about half an hour longer. The mixture is then ready to put into the spraying machine, but it should be carefully strained as it is being poured into the tank. It should be applied to the trees while hot.

There are two methods of boiling the mixture, either in large iron kettles holding from sixty to eighty gallons as shown on the cover, or in barrels or tanks with live steam. The former method will be found quite satisfactory for small orchards, especially if two or three kettles are used so that a quantity of the mixture may be in constant preparation. For large orchards large vats holding two or three hundred gallons or more are built, usually four or five feet above the ground so that the mixture can be conveniently drawn off into the spray tank, and the contents steam-boiled for two hours. Where practicable the steam-boiling method is to be preferred as there are no open fires to watch and the boiling is apt to be more thorough.

When well made the lime-sulphur-salt wash is a heavy, caustic, somewhat brownish liquid having a strong sulphurous odor. After standing for a short time the heavy ingredients settle leaving a clear reddish liquid. Long reddish crystals will also soon form in the precipitate.
Fortunately there is no need for a special spraying outfit to apply this wash. Any machine that is satisfactory for bordeaux mixture will answer. As is the case with bordeaux, however, a pump that will give a high uniform pressure will give the best satisfaction. As to nozzles, a number of different makes were tested during the Station experiments with the result that the McGowan and Vermorel gave the best results.

Caution. The caustic properties of the wash make it necessary to use care in protecting the hands and face while spraying. Rubber gloves will be found very satisfactory for the hands, and the eyes and face may be protected in large measure by a broad-brimmed hat.

As previously stated the chief objection to the use of this insecticide here in the East, has been that it was supposed to be too easily washed off by our spring rains to prove an effectual insecticide. It was therefore considered desirable to so plan the experiments as to secure all the data possible on this point during the season and hence arrangements were made to treat orchards in four different sections of the state, namely, on Long Island near Riverhead, in the upper Hudson Valley near Kinderhook, Columbia County, in western New York at Geneva, Ontario County, and near the extreme western part of the state near Youngstown, Niagara County. Over 700 trees were treated of which 251 are peaches including eleven varieties, 129 plums, Japan varieties, 284 pears, including about six varieties, 63 apple trees of which 48 are Baldwins of exceptionally large size and the remainder younger trees of miscellaneous varieties. Nearly all of the treated trees were badly infested.

The spraying was begun on Long Island, Mar. 25, and finished in Niagara County, April 16. With the exception of the apple orchards at Geneva and the pear orchard in Niagara County, the buds had only just begun to swell when the treatment was made. The remaining trees were farther advanced, many of the leaf buds having burst before the work of spraying could be finished.

Fortunately for the experiments the weather conditions at the time of application and during the season were such as to test
the adhesive qualities of the wash severely. On Long Island the weather was comparatively favorable but in Columbia County a snow storm followed by a freezing rain during the night occurred while the mixture was being applied. Although the trees were dripping wet the following morning the spraying was continued with the result that the wash adhered much better than was expected. While the Geneva orchards were being sprayed there were two heavy showers and in Niagra County the work was stopped twice by heavy, washing rains. In every case except on Long Island the weather during the first four weeks after the treatment, and also during the season, was unusually wet with frequent heavy showers.

The results should be considered from three standpoints: First, the effect of the treatment upon the trees; second, the effect upon the scale; and third, the effect of the weather upon the wash itself. They may be briefly summarized as follows: There was no apparent injury in any case except a possible very slight injury to the fruit buds of some of the Japan plums. The only effect of the treatment upon the trees was to delay the appearance of the foliage about a week. In every case the foliage was finally as thrifty as that of normal, untreated trees. In every case, also, the effect upon the scales was all that could be desired. Although nearly all of the treated trees were badly encrusted, only an occasional live scale could be found after treatment. The most striking results, however, were in the Baldwin apple orchard at Geneva. In this case the crop was nearly four times greater this year than for the past five or more years and, although the orchard received no other treatment, the fruit was not only practically free from the scale but free from scab as well. It was clean and marketable. This increase in yield may not have been entirely due to the lime-sulphur-salt wash, but it shows that the wash did not injure the fruit buds. The small amount of fruit previously secured from this orchard since infestation was nearly always unmarketable because of infestation with the scale. As further showing the result of the treatment, the fruit of the check trees, which were infested with the scale to about the same degree as the treated trees, was not only so badly
infested as to be unmarketable, but was not considered worth harvesting.

In spite of the frequent heavy washing rains characteristic of the season, the wash adhered well to the trees. Most of them, especially the rough barked apple trees, remained white during most of the summer.

An extensive series of experiments with infested apples in the laboratory as well as observations in the treated orchards show that the wash kills the scale in two ways, first through its soluble ingredients, as a direct contact poison killing the scales soon after it touches them, and second, through its heavy insoluble or slowly soluble ingredients as an indirect insecticide. These heavy ingredients form a crust on the bark, preventing the normal development of the young scales.

Experiments with lime-sulphur washes resulted in showing that the scales can be killed with the sulphur used at the rate of one pound to each ten pounds of lime. This may be considered the minimum. Owing to the presence of the foliage, however, summer treatment for the San José scale is not usually satisfactory.

A variety of other washes, including resin and casein, potash-sulphur, and lime and kerosene were tested on a comparatively small scale, but with the result that they gave no better satisfaction than the lime-sulphur-salt wash. The most promising is a compound made much the same as the lime-sulphur-salt wash except that caustic soda is used in the place of salt and the mixture does not require boiling. Further experiments are being made with this wash. The lime-sulphur-salt wash was also combined with bordeaux mixture, using one pound of dissolved copper sulphate to each eleven gallons of the diluted wash, with entire success.
1. No special apparatus is required to apply the mixture.

2. Reasonable care should be taken to protect the hands and face while spraying.

3. The wash may be applied in the spring a short time before the buds begin to swell. It may be combined with bordeaux mixture by using one pound of dissolved copper sulphate to each eleven gallons of the diluted wash. Dilute the copper sulphate solution before adding to the mixture.

4. But one application is necessary provided that application is very thorough. Much pains should be taken to cover the trees from the ground to the tips of the highest branches. If the orchard is badly infested, but worth saving, it will usually pay to go over the trees a second time and spray any branches that may have been missed the first time. When thoroughly sprayed the trees have the appearance of having been white-washed.

5. The lime-sulphur-salt wash appears to be one of the most promising remedies for the San José scale and is well worthy a thorough trial.
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