

EXPERIMENTS WITH SULPHUR SPRAYS FOR THE
FALL TREATMENT OF THE SAN JOSE SCALE.

THE LIME-SULPHUR-SALT WASH. THE LIME-SULPHUR-COPPER SULPHATE
WASH. THE LIME-SULPHUR-SODA WASH. DESCRIPTIONS OF
SOME OHIO SPRAYING PLANTS.

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EXPERIMENTS WITH SULPHUR SPRAYS FOR THE FALL TREATMENT OF THE SAN JOSE SCALE.

BY P. J. PARROTT AND J. S. HOUSER

Extensive experiments have recently demonstrated that spring applications of the lime-sulphur-salt wash efficiently control the San Jose scale. This has suggested the possibility that applications of the same mixture made in the fall during an extended period of warm weather, while the young scales are still alive, might be equally effective. There is a great demand for a cheap and efficient fall spray for the scale, especially by fruit growers controlling a large acreage, who, hindered by bad weather and the slow work of spraying apparatus in vogue today, often find it difficult to treat their trees within the customary time in the spring in as thorough a manner as is required to secure the best results in the treatment of this pest. The lime-sulphur-salt wash has proven very satisfactory for the early spring spraying and seemed to be equally promising as a fall spray; but data based on careful field experiments were needed to determine its value when applied at this latter season in this state. To obtain reliable data upon this point a badly infested orchard in Lucas county was placed at the disposal of the Experiment Station, and early last November applications of the wash were made to a goodly number of the trees, which were selected because of the abundance of scales upon them. Careful observations have been made from time to time throughout the past year upon the condition of the trees treated. The results from the treatment have been entirely satisfactory. For the benefit of those who contemplate spraying with the wash this fall, the present bulletin is issued as a preliminary report upon the progress of the work to date.

DESCRIPTION OF TREES.

The orchard reserved for treatment in this experiment consisted of 41 peach and 57 plum trees. The peaches included two varieties, 36 Elbertas and 5 Crosbys. These are seven years old and have been known to be infested with the scale for the past five years. They have produced one full and four moderate crops of fruit, which have been unsalable because of scale. All the trees were much infested, most of the bark being thickly incrustated, and the leaves and fruit considerably spotted with the scales. At the time of the application of the wash larvæ were very numerous. In 1900 the trees were sprayed with whale oil soap, and in 1901 with a strong caustic soda and resin wash.

Of the plums there were two varieties, 31 trees of Burbank and 16 of Lombard. They are about seven years old and, though having been in bearing for four years, they have only had one full crop of fruit, which was worthless because of the scale. The trees, though much infested with the scale, did not appear to be suffering, aside from the dying back of some small twigs at the tips of some of the branches. The trees were first discovered to have the scale about five years ago, and have in recent years been treated once with whale oil soap, and again with a strong resin wash.

DESCRIPTION OF CHECKS.

Forty trees were left unsprayed and were reserved as checks to compare with the treated trees at the final examination in estimating the value of the wash. The checks included ten trees of each variety and were of the same age and condition as those sprayed.

PREPARATION OF WASH.

The formula used in this experiment is as follows and the wash was prepared in the manner described:—

Lime	15 pounds
Sulphur.....	15 pounds
Salt.....	15 pounds
Water.....	50 gallons

The wash was made in a sixty-gallon iron kettle, by first slaking the full amount of lime to a thin paste with hot water. The sulphur and salt were then added separately in the order given and were well stirred in. The mixture was now brought to the boiling point and allowed to boil for one hour, a bucket of water being added now and then to replace that which was lost in the process of cooking. Frequent stirring of the wash prevented the caking and burning of ingredients upon the sides of the kettle. At the end of the hour

enough water was added to make the required fifty gallons of wash, which was again brought to the boiling point and then emptied into the spraying barrel for immediate application, being first strained through common wire fly screening to remove the coarse particles.

CONDITIONS.

The trees were sprayed November 17th and 18th. At this time not quite all of the foliage had fallen. During the application of the wash the weather was clear or slightly cloudy, with very little wind. The temperature varied from 40° to 61° Fahr. The precipitation for the next two weeks was as follows: Nov. 22, .02 inch; Nov. 26, .49 inch; Nov. 27, .41 inch; Nov. 29, .02 inch; Dec. 2, .27 inch; Dec. 3, .04 inch. The trees were sprayed once carefully, much pains being taken to cover all parts with the wash. The few leaves which still hung to the tips of the top branches did not prevent thorough treatment. The trees were not retouched or retrimmed after the first spraying. An Eclipse pump and Vermorel nozzles were used to apply the wash.

EFFECTS UPON WASH.

During the thirty days immediately following the application of the wash, there were heavy rains November 26 and 27 and December 2, 7 and 13. An examination of the orchard December 14 showed that the wash was adhering well, and seemed to be very little affected by the weather. On March 26, the wash had weathered off, leaving a greyish residue in the cracks and crevices of the rough bark of the trunks.

RESULTS ON PEACHES.

All the trees had an abundance of blossoms and leaves, and there was no appreciable difference between the treated and untreated trees. On June 8 the sprayed trees appeared to have a more abundant foliage and to be making better growth than the unsprayed. About July 14 the unsprayed trees seemed to be ailing and were dropping their foliage. Upon the ground about the trees there was an unusual number of dead leaves for this season of the year. Many of the leaves upon the trees were marked with purple spots and others were turning to a yellow or red and falling. The crop of fruit was very small and was being infested with young scales. The treated trees appeared to be very healthy and were making an excellent growth. There was much more new wood and much more foliage upon these trees than upon the checks. (Plate I, Figs. 1 and 2). The amount of fruit was about the same as on the untreated trees but with a few exceptions it was entirely free

from scale. A careful examination of the sprayed trees was made August 14 with the following results:—The trees were practically free from scale, only a few specimens being found at the base of some of the new growth. Solitary scales were found upon three fruits; with this exception the fruit and foliage were entirely free. There were much more foliage and new growth than upon the unsprayed trees.

RESULTS ON PLUMS.

The plums were examined upon the same day as the peaches. No differences were detected between the sprayed trees until July 14, when the good effects of the spraying were commencing to be apparent. The fruit of the untreated trees had practically all dropped and was much infested. The leaves were well marked with purple spots and the dead wood from last year's injuries was very conspicuous because of the scanty foliage. The leaves of the sprayed trees were clean and free from scale, and a vigorous growth had practically concealed the dead wood. Nearly one half of the crop of fruit had dropped from brown rot and curculio injuries, but there was very little evidence of scale upon the fallen plums. The fruit upon these trees was green and except in a few instances was free from scale. August 14, the destruction of the scale upon the Lombards seemed complete, but with the Burbanks the results were not quite so satisfactory, owing to their rough bark, which undoubtedly protected a number of the scales from the spray. These trees made a vigorous growth, producing a dense foliage which was quite free from scale. The fruit was as a rule clean, but still a few plums were found marked with the scale. At the base of the new growth of five of the trees small colonies of young scales were found, but with these exceptions the treatment had almost destroyed the scales.

EFFECTS UPON SCALE.

As all the trees selected for the experiment were badly infested there was an excellent opportunity for observing the effects of the wash upon the scale. An examination made March 26, showed that a very large percentage of scales on all the treated trees had disappeared, leaving the bark smooth and shining in small areas, while of the old scales that remained very few showed any evidence of a living insect beneath, and nearly all were weather-worn and flaking off. On June 8 there were found on five of the Burbanks and one Elberta a number of nearly full-grown females, but there was no evidence of active larvæ. A careful examination of all the trees was

made July 14 and 15 with the result that a few larvæ were found upon the new growth and upon some leaves and fruits of five of the Burbanks. A few scales were found upon the new growth of some of the peach trees and Lombards. August 14 there was very little difference from previous examinations. The few scales that had escaped treatment had made very little headway.

AN EXPERIMENT WITH THE OREGON WASH.

The purpose of this experiment was to ascertain the value of the Oregon wash for the fall treatment of the San Jose scale in comparison with contemporaneous applications of the lime-sulphur-salt wash. Both mixtures have been extensively used this past spring by orchardists with very little understanding, apparently, of their comparative merits. The former has been preferred in this state but this preference does not seem to have been founded upon critical tests to determine their relative values. To obtain data upon this point, twenty-three Elbertas and ten Burbanks were treated with this spray.

PREPARATION OF OREGON WASH.

The formula used in this preparation of the Oregon wash is as follows:—

Lime.....	15 pounds
Sulphur.....	15 pounds
Copper Sulphate (blue vitrol).....	1½ pounds
Water.....	50 gallons

The wash was prepared in the following manner:—The full amount of lime was slaked with hot water and during the slaking process the sulphur was added and well stirred in. The mixture was then diluted to form a thin paste. This was allowed to boil for one hour, after which enough water was added to make about forty-eight gallons. This amount was brought to the boiling point and was emptied into the spraying tank, being first strained through common wire screening. The copper sulphate was now added, having been dissolved separately in two gallons of warm water. The mixture was then well stirred and immediately applied.

CONDITIONS:—The trees treated by this wash included the same varieties, and were similar as regards vigor, growth and degree of infestation with the scale, to those in the preceding experiment. The conditions of weather and the manner of treatment were also the same. The checks were the same as in the preceding experiment.

RESULTS UPON SPRAYED TREES.

The Elbertas and Lombards were carefully examined during the summer. In no instance were scales found upon fruit or leaves, and in the case of the latter, none upon any of the growth. A few young scales were found at the base of the new growth of eight of the Elbertas. With this exception the trees of this variety were remarkably free from the scale and had been greatly benefited by the treatment. As in the preceding experiment, the results with the Burbanks were a little disappointing, as a few young scales were found upon some of the fruits and leaves and especially at the base of the new growth. The foliage of these trees was more abundant and healthier than that of the checks. As the checks were the same as with the lime-sulphur-salt wash, a description of their condition is not necessary.

EXPERIMENT WITH A SODA-SULPHUR WASH.

Since the discovery that the lime-sulphur-salt wash is adapted to eastern conditions, it has been thought that perhaps an equally efficient wash, which would be less expensive and more convenient to prepare, could be made by substituting either caustic soda or potash for a part or all of the lime in this wash. By so doing it was thought possible to shorten the time for the preparation of the wash if not to dispense with the costly cooking outfits. With these objects in view several formulæ were suggested, using various proportions of soda or potash to dissolve the sulphur, which seemed exceedingly promising. Of these* the following was selected for a test:—

Lime.....	20 pounds
Sulphur.....	10 pounds
Salt.....	10 pounds
Caustic soda.....	5 pounds
Water.....	50 gallons

The wash was prepared by dissolving the caustic soda in two gallons of hot water. To this the sulphur was added, much pains being taken to keep the mixture well stirred and to prevent burning upon the sides of the kettle. Whenever necessary water was added to replace that lost in the cooking. After boiling for twenty minutes, at which time the sulphur was completely dissolved, enough hot water was added to make about thirty gallons of the solution. In the meantime the lime had been slaked separately and mixed with hot water to make about twenty gallons. To this the salt was added and stirred until completely dissolved. The soda and sulphur

*The writer is indebted to Prof. A. D. Selby, Botanist of this Station for the above formula. This is one of a number which are being tested by him to determine the value of sulphur sprays for the prevention of plant diseases.

mixture was now added to the lime and salt mixture and was thoroughly stirred to get the ingredients well mixed. This completed the preparation of the wash, which, being strained to remove the coarse particles of lime, was emptied into the spraying tank and applied hot.

A modification of this wash was also tried in which three pounds of copper sulphate (blue vitrol) were substituted for the salt. The copper sulphate was dissolved in three gallons of hot water, which was then added to this lime paste, before the addition of the soda and sulphur solution in the above formula.

TREES TREATED.

These mixtures were applied to fourteen apple trees, including two varieties, Ben Davis and Jonathan. The trees were eight years old, and having been under careful cultivation had made an excellent growth. About five years ago they were found to be infested with the scale, but nothing was done to combat the pest, which was allowed to increase in destructive numbers until 1900 and 1901, when the trees were treated with whale oil soap and soda and resin mixture respectively. The trees had produced some fruit but it had little value, being badly infested by the scale. Some foliage still remained upon the topmost branches, but this did not prevent the thorough coating of the bark with the wash.

CHECKS.

Forty trees of the same variety and same condition with respect to growth and infestation were reserved unsprayed, to compare with those under treatment. This number afforded an excellent basis for comparison.

CONDITIONS.

The trees were sprayed November 19. The weather was warm and sunny, with very little breeze stirring. Each tree was treated once carefully, and was finished before passing to another. About three and one-half gallons of the wash were used to treat one tree. The precipitation for the two weeks following the application was the same as in preceding experiments.

EFFECTS OF WEATHER UPON WASH.

Neither wash adhered as well to the trees as the lime-sulphur-salt mixture. On December 14 the washes presented a very streaked appearance, and by March 25 had almost entirely disappeared, giving the bark a peculiar reddish or bronzed effect.

EFFECTS OF WASH UPON SCALE.

An examination for the effects of the washes upon the scale was made March 26. At this time the applications appeared to have worked very unevenly. There were patches here and there in the midst of the heavy incrustations that were entirely clean, while elsewhere the mass of the scales seemed very little affected. At a rough calculation not more than thirty-five to fifty-five per cent. of the scales appeared to be destroyed. On June 8 a large number of nearly mature females were visible on all parts of the trees. In early July larvæ were appearing in large numbers and settling upon the bark, leaves and fruit. To all appearances the wash accomplished very little good.

The scales treated with the soda, sulphur and copper sulphate seemed to be affected in the same manner. The treatment did not prevent the fruit from being rendered unsalable because of the spotting by the scale, nor did it check further injuries to small twigs and branches.

An examination was made again August 14, and at this time there was little practical difference between the treated and untreated trees.

EFFECTS UPON APPLES.

The results from the soda-sulphur wash, either with or without the copper sulphate have, perhaps, already been indicated. The fruit and leaves upon the trees were badly infested and much spotted with red by the young scales. The incrustation upon the large limbs and branches did not appear to be as heavy as before treatment, but the numbers of the scales were not sufficiently reduced to be of any practical benefit to the trees. During the latter part of the summer the trees seemed to be sickly. The foliage was sparse and more branches and twigs were succumbing to injuries by the scales.

PREPARATION AND APPLICATION OF THE
LIME-SULPHUR-SALT WASH.

The lime-sulphur-salt wash has proven to be well adapted to the needs of many orchardists in Ohio, and will occupy an important place in spraying operations in the future. The extensive tests that have been made by practical men and the Experiment Station this past spring have demonstrated that the lime-sulphur-salt wash, at the strength usually recommended, not only efficiently controls the San Jose scale but is besides of much value in holding in check the peach leaf curl. The results secured by the tests were so highly satisfactory that even the most skeptical were convinced of the efficient qualities of this wash for the spring treatment of these two

destructive pests of the peach orchard. As a consequence many more orchardists are going to use this wash in the future, and already plans are being made for next spring's campaign. To meet the growing demand for information it is thought best to include directions for the preparation and application of the wash.

FORMULA.

There are many formulæ given for preparation of this wash, but the one that has given the most satisfaction, considered from all standpoints, is made as follows:—

Lump lime.....	50 pounds
Salt ¹	50 pounds
Sulphur.....	50 pounds
Water	150 gallons

Place the full amount of lime in the kettle or vat, or whatever the receptacle may be, and start it to slake with hot water, using enough to prevent the lime from being air slaked, but not enough to drown it. During the slaking process add the sulphur, all lumps having first been pulverized, and the salt; stir both of them thoroughly, and add water gradually to reduce the mixture to a thin paste. If the mixture is not already boiling, bring it to this point and allow it to boil for one hour. If the wash is prepared in an iron kettle it will be necessary to add a bucket of water now and then to replace that lost in the boiling process, and to stir the mixture frequently to prevent burning and caking of materials upon the sides of the vessel. After one hour's boiling enough hot water should be added to make the required amount of mixture, or if cold water is used the proper porportion should be added and the wash again brought to the boiling point. The wash is now ready for use. It should then be emptied into the spraying barrel, being strained through common wire screening, and if possible applied while hot to the trees.²

¹The salt may be omitted. In some preparations the salt seems to make the wash more adhesive, while in other preparations, by the same formula, no additional adhesiveness may be gained by its use. Applications of this wash, made with and without salt, have this year proven equally efficient in the destruction of the scale. I am indebted to Prof. A. F. Burgess, Chief Inspector of Nurseries, Columbus, Ohio, for an opportunity to see the results of some of his careful experiments to determine the value of salt in this sulphur spray. This recommendation is based upon the results of a careful examination of these experiments.

²In preparing the Oregon wash, this same formula is used, with the exception that from five to six pounds of copper sulphate (Blue vitriol) are substituted for the salt. The copper sulphate should be dissolved separately. When the lime-sulphur material has been properly cooked and emptied into the spraying tank, then add the copper sulphate solution. Stir the mixture well before applying.

PREPARATION.

To prepare the wash satisfactorily it is necessary to have a suitable outfit. In making plans for such one should remember that the kind of plant, with reference to the use of kettle or steam to prepare the wash, location in regard to an abundant supply of water, and the number of handy contrivances for handling water and the wash, have much to do with the ease and cost with which this spray can be made and applied. If possible, use the steam to prepare the wash. The outlay for a suitable plant need not be large, especially if the orchardist possesses mechanical ingenuity, for by using parts of old spraying apparatus and second-hand machinery, one may provide a very satisfactory outfit with comparatively little expense. The following brief descriptions, accompanied by photographs of plants used in Ohio for the making of the wash, will serve as a guide for the erection of an outfit adapted to individual circumstances.

SMALL OUTFITS.

Two iron caldrons of sixty gallons capacity will make an outfit at a small outlay (Plate II, Fig. 1). It is not the most convenient arrangement but will answer very well the purpose of the owner of a small orchard, who would hardly find it profitable to erect a more elaborate plant. With such an outfit one can prepare in a day from three to four hundred gallons of wash, which will be sufficient to treat about two hundred and fifty trees of the size of seven-year-old peach trees, employing one man to prepare the wash, one to hold the nozzle and another to operate the pump. The cost for caldrons, spray pump and barrel will be from twenty to thirty dollars.

LARGER PLANTS.

A larger and serviceable plant is that of Mr. Geo. R. Marshall, Gypsum, O. It consists of a threshing engine to furnish steam, a wooden cask to cook the wash, and a mortar box in which to slake the lime (Plate II, Fig. 2). From the steam dome of the boiler there is an overhead pipe, which terminates in a downward extending arm to the bottom of a cooking tank of about five hundred gallons capacity. Fitted to this pipe is a valve at a convenient height to control the inflow of steam. The capacity of the plant is about two thousand gallons of wash per day. This amount is considered sufficient for about one thousand seven-year-old peach trees. Four men are required to prepare and apply the wash. The cost of the plant is as follows:—

10-H. P. boiler.....	\$300.00
Boiling cask.....	15.00
Pipe fittings, etc.....	25.00
Spraying outfit, pump, tank and hose with couplings and nozzles	40.00

A spray-boiling plant (Plate III, Fig. 1) admirably adapted to the needs of Duroy & Yule, Lakeside, may be described as follows: From an over-head pipe leading from the steam boiler, there are two downward extending arms about five feet apart, one leading to a common oil barrel and the other into a cask of about 150 gallons capacity. Both arms are fitted with valves to regulate the inflow of steam. In the smaller barrel a concentrated mixture of the lime-sulphur and salt is prepared. In the larger cask the necessary amount of water is heated to the boiling point, to which is added a sufficient quantity of the concentrated sulphur wash of the first barrel. One man prepares and two apply the wash. The cost is as follows:—

5-H. P. boiler, second hand.....	\$30.00
Boiling tank.....	1.00
Diluting tank.....	1.50
Piping, valves and injector.....	40.00
Spraying tank, 150 gallons capacity.....	10.50
Spraying pump, hose, "6-cluster" nozzles.....	38.50
Capacity of plant per day, 800 gallons.	
Capacity of spraying machine per day, 600 gallons.	

For treating a large number of trees a plant after the style of the outfit illustrated in Plate III, Fig. 2, belonging to Mr. Bert Lockwood, of Gypsum, seems to be popular among orchardists. The wash is cooked and diluted in tank *a*, the water being piped from tank *c*. Tank *b* is used for slaking extra lime and heating water, and is connected by a pipe to *a* below. An injector is used to obtain water from an adjoining pond to fill boiler and tanks. One man prepares the wash, one operates the pump and one sprays, using a cluster of six nozzles. The cost of the plant is as follows:

Building.....	\$150.00
Pump, engine with pipe fitting.....	100.00
10-H. P. boiler.....	75.00
3 tanks, <i>a</i> 400, <i>b</i> 200, <i>c</i> 100 gallons.....	50.00
Capacity of plant per day, 1000 gallons.	
Number of trees treated per day, 300 to 700 7-year-old peach.	

To fruit growers owning a large acreage, the plant of W. H. Owen, Catawba Island, (Plate IV, Figs. 1 and 2) will be of interest because of its capacity to prepare and apply large quantities of the wash. A concentrated mixture of the wash is prepared in a steel boiling tank, which is then allowed to flow into a tank below, where it is diluted with enough hot water to make the required 1000 gallons

of the wash. A Loop compressed air spraying outfit is used. One man prepares the mixture while another sprays, using a compressed air machine, fitted with an upright, pivot-jointed standard, containing twelve nozzles. The items of cost for such a plant are as follows:—

10-H. P. boiler, second hand	\$90.00
Steel boiling tank, 380 gallons capacity.....	40.00
Steel diluting tank, 1000 gallons capacity.....	70 00
Water storage tank (galvanized) 350 gallons capacity.....	9.00
10-H. P. engine, second hand..	50.00
Compressed air tank, 150 gallons capacity.....	50.00
Air compressor.....	70.00
Two wagon tanks, 120 gallons each.....	70.00
Capacity for cooking plant per day, 5000 gallons.	
Number of trees (7-year-old peach) treated per day, 1500.	

TIME OF APPLICATION.

The wash may be applied with satisfying results in the fall or spring. If the treatment is made in the fall, spray as soon as the majority of the leaves have fallen, advantage being taken of a warm spell of weather, and while the young scales are yet active, to make the treatment. Spraying at this season is only advised when the weather in the spring is not to be depended upon, or when it is desired to lighten the work of spring spraying. Peach trees sprayed in the fall should be treated in the spring as usual with Bordeaux mixture to prevent leaf curl. Spring treatment with the sulphur wash should be done before the opening of the buds.

DIRECTIONS FOR SPRAYING.

The mixture should be strained through common wire screening to remove coarse particles. To make an application, select a nozzle with a fine aperture, after the styles of the Vermorel and Spramotor nozzles, because the best results are secured by the use of a fine or misty spray. With such a nozzle one saves material and does better work in controlling the scale and plant diseases. Spray with the wind, as the work can be done cheaper and better and is less disagreeable, since one avoids getting the spray upon himself and horses. Hold the nozzles high in the air and allow the misty spray to drift with the wind through the tree until all the parts on one side, as far as the operator can conveniently cover, have received thorough treatment. When the wind changes spray from the opposite direction. The work can be done more rapidly if instead of one or two nozzles, a cluster of six or eight are employed. If the mixture is applied while the trees are dormant there is very little danger of injury to the buds. The wash is very safe and should be applied in liberal quantities to insure thorough treatment.

SOME SUGGESTIONS.

The wash is very caustic; for this reason one should handle it as little as possible. Have the cooking plant so arranged that the mixture, when it is prepared, may flow directly into the spraying tank without bailing. If the nozzles clog frequently use finer screening to strain the mixture. If the suction strainer clogs up often agitate the mixture frequently or raise the pump so that the suction strainer is an inch or more above the sediment. To correct a leaky plunger or piston, remove old packing and repack with square braided flax or candle wick, well soaked in a hot mixture of 2 ounces of graphite and one-half pound of tallow. To avoid getting the wash upon the person, never spray against the wind, and have all nozzle and hose connections tight. To protect the hands wear the ordinary leather working gloves. To prevent the pounding of steam upon the bottom of the cooking cask attach several arms or a coil of perforated pipe to the end of the discharge steam pipe. To avoid unnecessary corrosion of hose and pump rinse them out well with water after each spraying operation. By following these directions this wash will be but very little more disagreeable to apply than other spraying mixtures.

SUMMARY.

The first of the experiments discussed in this bulletin was made to determine the value of fall applications of the lime-sulphur-salt wash for the control of the San Jose scale. This treatment was not detrimental to Elberta or Crosby peaches, Burbank or Lombard plums, and in the destruction of the scale compared favorably with the results obtained in early spring applications.

Owing to the slight attack of leaf curl in the orchard, the experiment furnished no evidence of the value of fall applications of this sulphur spray for the prevention of this disease. Brown rot and Shot-hole fungus were prevalent upon the sprayed trees.

The results from the fall applications of the Oregon wash demonstrated that it is a safe and reliable remedy for the scale but possesses no practical advantage over the lime-sulphur-salt wash.

A soda-sulphur wash containing one-half of the amount of sulphur and substituting caustic soda for a part of the lime in the lime-sulphur-salt wash, was tried upon twenty-eight apple trees and proved to have very little insecticidal value.

PLATE I.

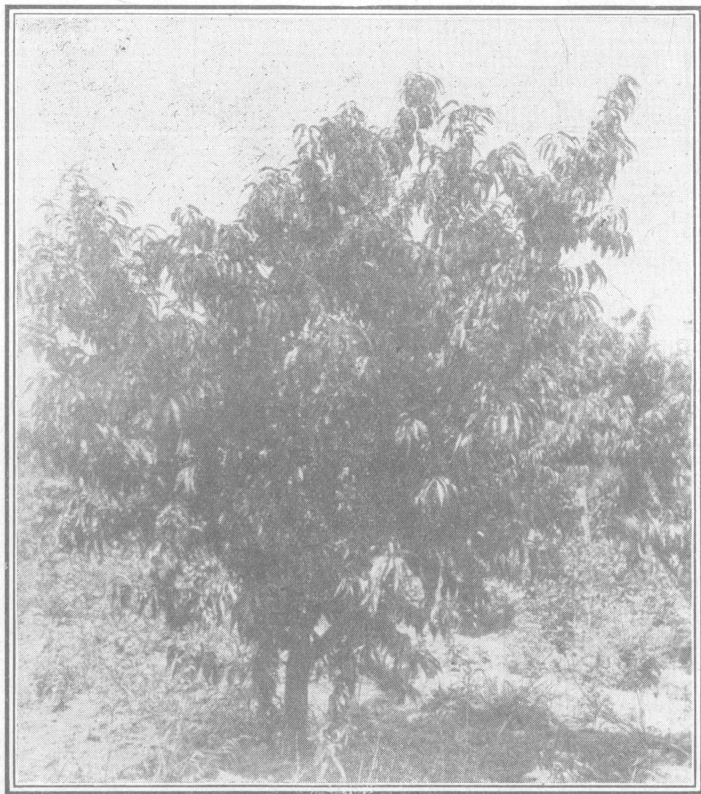


FIGURE 1—An unrayed Elberta.

Photographed July 14, 1903.

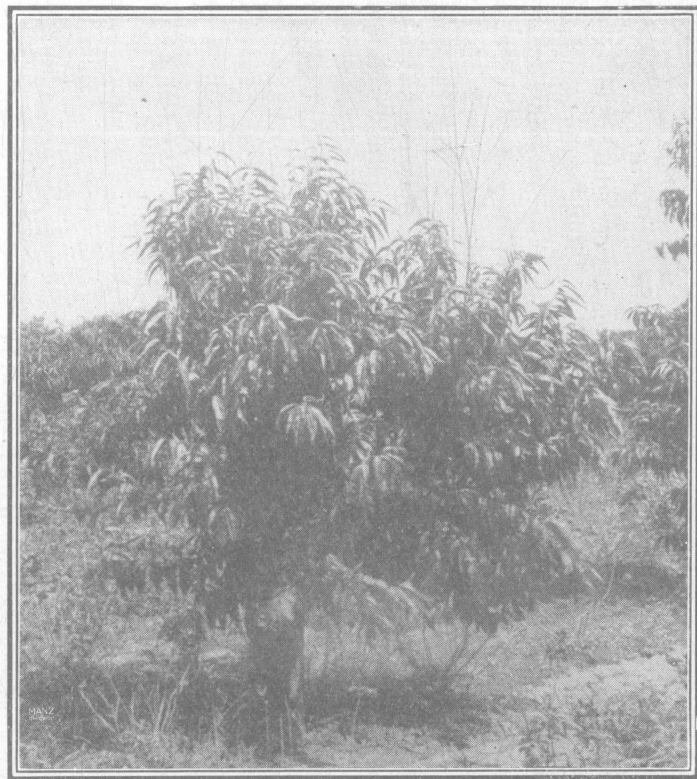


FIGURE 2. An Elberta sprayed with lime-sulphur-salt wash.

PLATE II.



FIGURE 1—Preparing wash with two cauldrons.

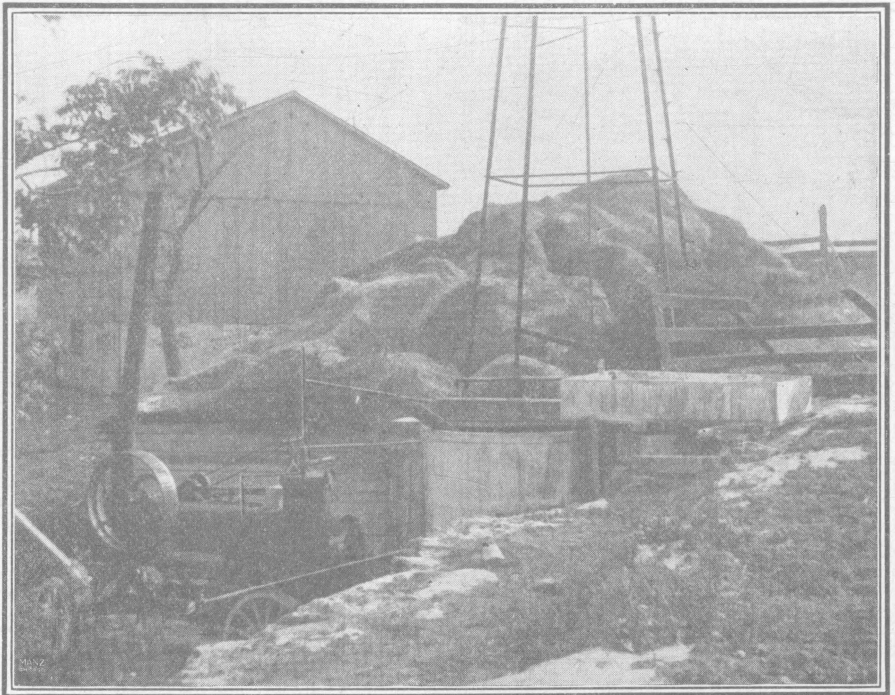


FIGURE 2—Plant of Geo. R. Marshall, Gypsum, Ohio.

PLATE III:

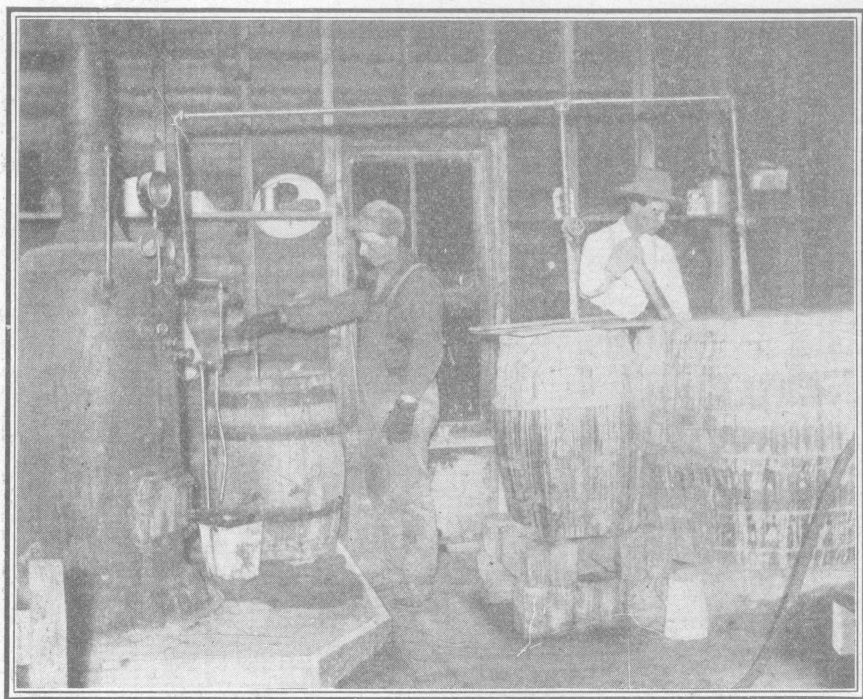


FIGURE 1—Plant of Duroy & Yule, Lakeside, Ohio.

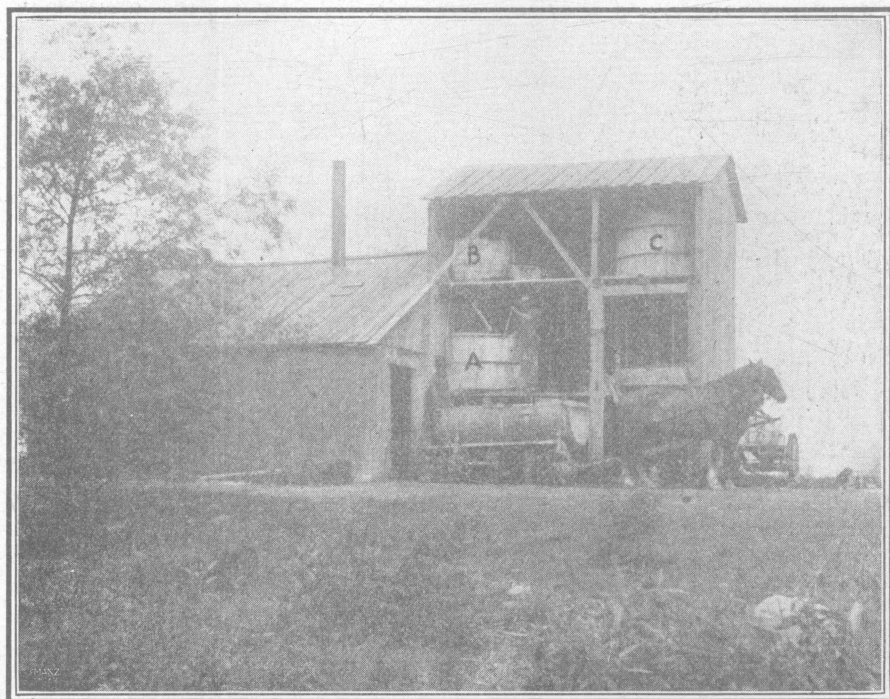


FIGURE 2—Plant of Robert Lockwood, Gypsum, Ohio.

PLATE IV:

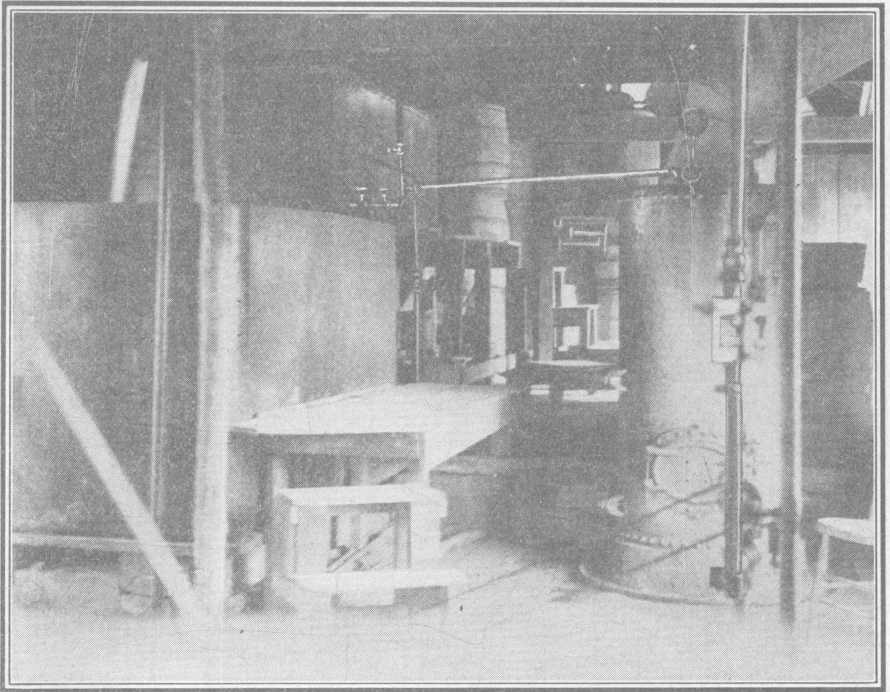


FIGURE 1—Plant of W. H. Owen, Catawba, Ohio.



FIGURE 2—A compressed air outfit with 12-nozzle standard. (W. H. Owen.)

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