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SELF BOILED LIME SULFUR and ITS USE

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Plate 1.—Showing a barrel outfit in operation with 2 lines of hose. This winter treatment should always be given to secure successful summer treatment.

SELF BOILED LIME SULFUR WASH AND ITS USE

With the exception of the late spring frosts the *brown rot* of the peach causes a higher percentage of loss to the growers than does any other agency. It is practically impossible to work out consistent percentages with sprayed and unsprayed trees year after year, but the growers will testify that unsprayed trees suffer losses of from 25 per cent. to 100 per cent. each season, depending of course, very much upon the season. During the season of extreme humidity, or when we have excessive rains just prior to the picking season, the greatest losses are incurred.

The disease works such havoc with the peach crop that in some sections the growers have applied the axe to the orchard, having found no method of successfully controlling the trouble. This rot continues to develop in the fruit while in transit from the orchard to the market. If the disease is present in the orchard, the healthy fruit becomes affected by handling. The portions of the fruits coming in contact in the crates, produces a so called "sweating," which creates moisture enough to germinate the spores. It frequently happens that the fruit reaches the market in a "spotted" condition.

At the suggestion of Prof. M. B. Waite, of the Bureau of Plant Industry, experiments were carried on by Prof. W. M. Scott, of the same Bureau, commencing in 1901, to determine, if possible, if a substitute for Bordeaux Mixture could be found. Although Bordeaux Mixture had been used successfully in combatting the apple diseases, it could not be used on peach trees. Even with apples there are still many objections to the Bordeaux treatment, as it injures the foliage of some varieties and also causes a "russetting" of the fruit. In 1907, Prof. Scott experimented with the various self boiled lime sulfur mixtures on the apple and peach. Before discussing the results obtained with the mixture, which has now been tested in practically all the large peach growing sections, let us consider the nature of Brown Rot itself, together with the chief means by which it is spread.

Brown Rot (*Sclerotinia fructigena*) is a fungus disease attacking the fruit either on the tree or in transit to market. Great losses

are also caused at blooming time, and the disease penetrates the bark and causes a canker to appear which often girdles the twig. The diseased blossoms turn brown and become dried and adhere to the twigs for several weeks. Many blooms and twigs are destroyed on trees in low, poorly drained lands even in dry seasons, but of course, the damage is much greater during wet seasons. Some of the diseased peaches may hang on the tree through the winter, and endanger the life of the twigs as well.

Although the fruits may rot when less than a half an inch in diameter, the trouble usually appears nearer the maturing period of the fruit. From the first appearance of the small brown circular spot on the fruit until it is entirely decayed, often consumes less than two days. For this reason many unnecessary losses are met as the grower starts his spraying too late. There are but few people who are not familiar with the latter stages of the disease when it has enveloped the fruit in a grayish brown moldy coat. Many of the rotted fruits shrivel up on the trees and pass the winter as "mummied fruits." In this form the disease is carried over winter. Many of the mummied fruits fall to the ground and lie exposed or are partially covered with soil through the winter. During the spring and summer, especially in wet seasons, spores developed from these mummied fruits are blown about and infect the crop. Again, during wet seasons the fruit becomes tender and watery, making it easier for the spores to attack it. Where the twigs become infected from the attached rotten fruits the fruit buds are of course destroyed, thus materially diminishing the crop for the next season. These diseased twigs appear very much the same as twigs on the pear or apple affected with "fire blight," and during the pruning these should be cut out and destroyed.

The mummied fruits which lie on the ground partially covered with soil develop another stage of the disease and form brown, cup shaped bodies, which produce millions of ascospores. These rise and float about in the air infecting the blossoms, where in turn there develops a summer crop of spores which later infect the young peaches. From this we clearly see the necessity of early spraying, and as the mummied fruits play such an important roll these should be carefully removed and destroyed. However, this alone cannot suffice, as one or two unnoticed mummied fruits will be enough to affect the next crop.

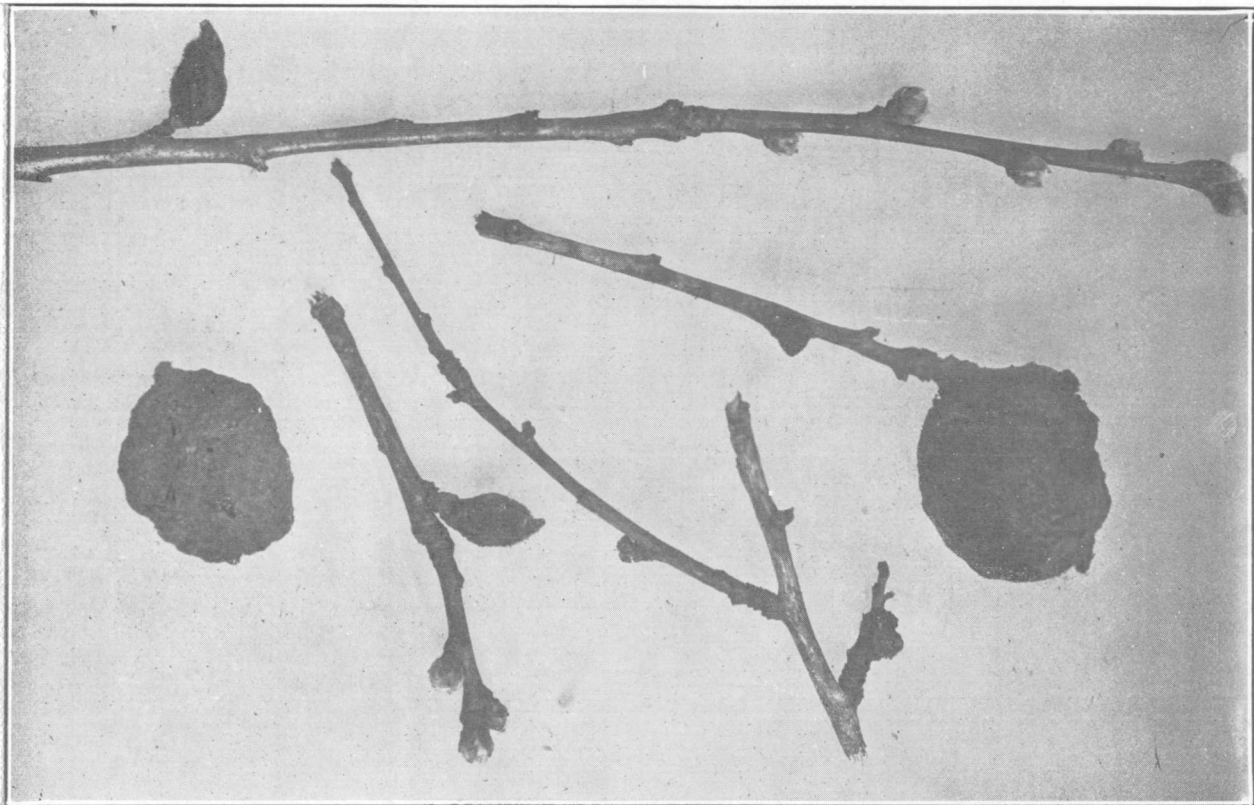


Plate 2.—Showing “mummied fruits” and blackened twigs attacked by Brown Rot.

PLUM CURCULIO.—Another enemy must be spoken of in this connection. What often appears to be a perfect peach when broken open displays the yellowish white grub of the Plum Curculio. Wormy fruit is worthless, however little the fruit may have been injured. It is usually considered that brown rot holds second place in the percentage of loss to the peach growers of Alabama, but from the fact that 93 per cent. of the fruit attacked by brown rot becomes infected through the punctures of the curculio, we might more properly assign this troublesome insect to second place.* Since the curculio and brown rot are so closely associated in peach injury, we may fight them both at the same time. To do this requires the application of an insecticide and also a fungicide. For the insecticide the following material is used :

2 lbs. Arsenate of Lead.
 3 lbs. Pure Rock Lime.
 50 gals. Water.

The arsenate of lead should be mixed into a paste in a bucket before adding it to the solution. Slowly slake 3 lbs. of rock lime in water. If the lime were not added there might occasionally be enough free arsenic in the solution, even with this insecticide to cause serious injury to the foliage. Some lots of commercial arsenate of lead may contain enough water soluble arsenic to burn the very sensitive foliage of the peach, so lime is added to combine with and neutralize it. This insecticide is applied just as the petals or so called "shucks" are falling.

For the second spraying we will simply add the 2 pounds of arsenate of lead to a self boiled lime sulfur spray solution. The fight against the rot must commence early or the work will be worthless.

Many are familiar with the preparation of the concentrated lime sulfur wash for the winter treatment of fruit trees in controlling the San Jose scale. The same ingredients are used for the self boiled wash, but the method of preparing it is radically different. It is very easy to confuse the two methods. The object in using the self boiled mixture is to obtain a solution which can be applied in summer without injuring the foliage. The winter wash used even at the rates of 1 to 50 and 1 to 100 caused injury to the fruit and foliage.

*See Georgia State Board Entomology Bult. 32, p. 38, 1910.

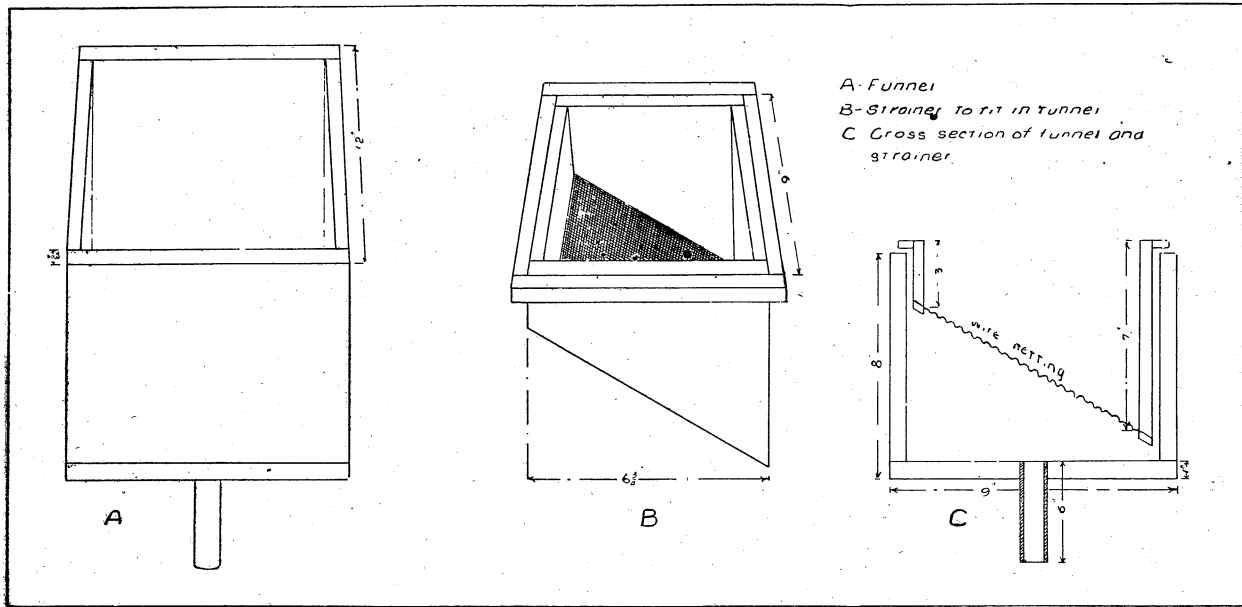


Fig. 1—Showing diagram for making a home-made strainer.

In the formula for the summer wash the amount of lime and sulfur is considerably reduced and consists of the following formula :

8 lbs. of pure unslaked lime.
8 lbs. of flour or flowers of sulfur.
50 gals. water.

In the preparation of the above no fire is used under the vessel in which the material is placed.

PREPARING THE SELF BOILED MIXTURE.—Into a strong barrel or an iron kettle place the 8 pounds of lime in 4 to 6 gallons of water which has previously been brought up to a temperature of 190 to 200 degrees. (In using warm water the lime begins to slake much quicker than in cold water.) As soon as the lime begins to slake pour in the sulfur, which has been freed from lumps by being passed through a screen, and stir vigorously for about 30 seconds. Cover the barrel with a heavy piece of bagging. Occasionally examine the mixture to see that it does not become too dry. If this happens add a little more water. Allow the boiling caused by the slaking lime to continue for about 10 minutes. At this point add sufficient cold water to stop the boiling. If boiling is allowed to continue too long an excess of sulfur will be dissolved, causing injury to the foliage. The mixture is now strained through a wire gauze having 20 meshes to the inch. (See Fig. 1). Wash and rub all the particles of sulfur through into the barrel during the straining.

With the best equipment and the best prepared mixture the results of the application will vary with different operators. In the case of the winter wash every portion of the tree should be covered with the spray. In applying the summer wash as just described, the drenching of the tree is not to be recommended. The object is to cover the peaches and twigs as expeditiously as possible.

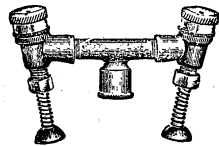


Fig. 2.—Showing a good type of nozzle.

Fifty gallons of summer wash will cover about 35 to 40 six year old trees. About 30 of the same aged trees can be covered with the winter wash if the trees have been previously well pruned. Pruning and spraying are both essentials in successful fruit growing.

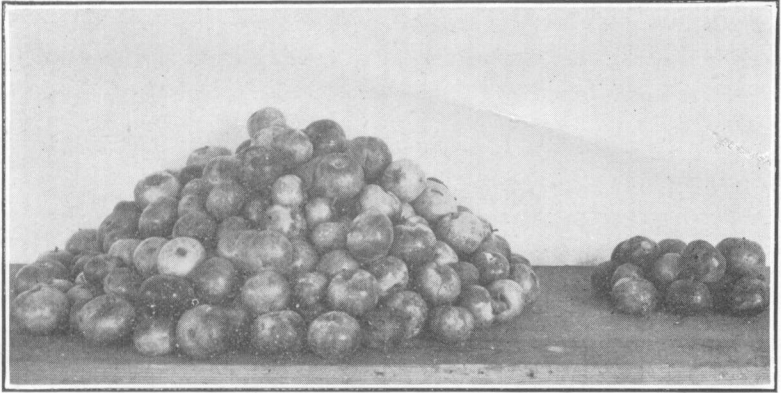
The first application of this self boiled preparation should contain 2 pounds of arsenate of lead, as the latter will still be effective against the *Curculio*. This mixture is known as the "self boiled lime sulfur arsenate of lead" solution. The time for applying it should be between two and three weeks later than the application containing the arsenate of lead and lime, which, as stated above, goes on just as the "shucks" are falling; or about 5 or 6 weeks from the time the trees bloomed.

The third application should be made about four weeks later than the second, and this time consists of simply the self boiled wash. Some varieties, such as Greensboro, Carman, Waddell, McKinnel and Hiley, which are all early or medium early ripeners, will mature on two sprayings in favorable seasons.

According to Scott the figures given on cost of spraying in using four men, one to prepare the mixture and three to spray, 500 to 800 trees can be covered in a day with a 200 gallon tank. With hand power the above cost per tree would vary from 1 1-2 to 2 cents, or 6 cents per tree for the three sprayings. Prof. Scott states that with a power sprayer four applications can be put on for about 5 3-4 cents per tree. Here at Auburn we have been using a 50-gallon barrel outfit. With two competent men 3 applications cost approximately 10 cents per tree. In a ten hour day with these two men the material has been prepared and applied to 300 trees averaging 7 years in age; this, of course, with every condition favorable.

Peach Scab (*Cladosporium carpophilum*), commonly known as "black spot" or "freckles," is another fungus disease attacking the peach. The spots are about one-eighth of an inch in diameter, and are dark brown or blackish in color. This often causes the fruit to split or shrivel along the suture and gives it a very unattractive appearance. The brown rot readily finds entrance through these spots and cracks. This fact should be considered in fighting the brown rot. Self boiled lime sulfur is a positive remedy for controlling scab.

Prof. Scott and co-workers do not recommend the self boiled lime sulfur wash as a positive remedy for apple "scab," and particularly the *bitter rot* of the apple. Where these troubles prevail, Bordeaux should be used in the spraying operations following the self boiled lime sulfur treatment. The mild cases of *scab* and the severe cases of *leaf spot*, *fruit spot*, and the *sooty fungus*,



A

B

Plate 3.—Apples sprayed. (A) Good fruit. (B) Rotten fruit.



A

B

Plate 4.—Apples unsprayed. (A) Rotten fruit. (B) Good fruit.

were controlled and prevented in the respective cases in the experiments conducted in 1909 at the Virginia Station. In these experiments the standard commercial concentrated lime sulfur solution was used at the rate of 1 1-2 gallons to 50 gallons of water, or by using the home prepared mixture at the rate of 4 pounds of sulfur and 2 pounds of lime to 50 gallons of water, with apparently no damage to the foliage.

The self boiled mixture was also used, and no damage whatever was done to the foliage; in fact, the report states that the leaves put on a healthier appearance.

In combining an insecticide with the self boiled lime sulfur, Paris Green was found to be injurious, burning the foliage badly. With the addition of 2 pounds of arsenate of lead to either the 1 1-2 to 50 commercial Lime Sulfur or the Self Boiled solution, there was no apparent injury to the foliage.

The results obtained at Auburn with lime sulfur on apples showed that where the trees were sprayed 98 per cent. of the fruit was perfect. (See Plates 3 and 4). The applications were made as follows:

FOR CODLING MOTH.

Arsenate of Lead, consisting of—

- 2 lbs. arsenate of lead.
- 3 lbs. pure rock lime.
- 50 gals. water.

This should be applied just after the petals drop.

FOR BLACK AND BITTER ROTS.

Self Boiled Lime Sulfur—

- 8 lbs. pure rock lime.
- 8 lbs. flowers or flour of sulfur.
- 50 gals. water.

This should be applied six weeks after the petals drop and at twenty day intervals.

The apple trees were treated with three sprayings. Although many varieties of apples can be successfully grown even in Central Alabama, it is certain that this cannot be done without proper attention being paid to spraying.

Prof. Scott's experiments showed that with the lime sulfur arsenate of lead mixture applied three times to peaches the percentage of perfect fruits was 81 per cent. The first spraying of arsenate of lead and lime and with the two following, the self boiled lime sulfur, with two pounds of arsenate of lead, 85 per cent. of the fruits were perfect. These tests were conducted with the Elberta and Belle of Georgia varieties.

The results at Auburn showed even higher percentages of perfect fruit. The notes were taken on Carman, Elberta and McKinnel varieties, and were as follows:

Sprayed.....	14 Carman.....	Average perfect	97.6 per cent.
Unsprayed ..	3 Carman.....	Average perfect	48.6 per cent.
Sprayed.....	6 Elbertas	Average perfect	92 per cent.
Unsprayed ..	2 Elbertas	Average perfect	75 per cent.
Sprayed.....	2 McKinnel	Average perfect	89 per cent.
Unsprayed ..	2 McKinnel	Average perfect	00 per cent.

With the last named variety the records show that in the past four years no fruit matured owing to the attacks of the rot. There were many other trees treated as above, but no actual count could be made in all cases. However, the high percentages of perfect fruit prevailed on all treated trees.

In an experiment with 1500 peach seedlings, the entire orchard was left unsprayed the past season. As a result only 2 per cent. showed resistance to brown rot, the remainder showing about 95 per cent rotten fruit.

With the work with peaches and apples alike much of the success with the summer treatment depends upon previous pruning and thorough winter spraying with the concentrated lime sulfur. The results would indicate this from the work done with both peaches and apples here at Auburn.

Dr. Powell, of the Bureau of Plant Industry, states that the advent of the self boiled lime sulfur wash has placed the peach industry of the East once more on its feet.

Some contend that there will now be an over supply of peaches. This may be true, but those who study market conditions carefully and endeavor to put out first class fruit year after year, will always be able to dispose of their fruit at good prices.

There were differences of from 20 to 36 cents in the prices offered on crates in the New York market in favor of the sprayed fruits. This alone pays for the spraying, but in addition it must be remembered that there are many more crates gathered from the sprayed than the unsprayed trees. This should persuade more Alabama growers to spray faithfully each year.

A barrel outfit similar to the one in use at the Experiment Station costs approximately \$22.00 with the necessary accessories.

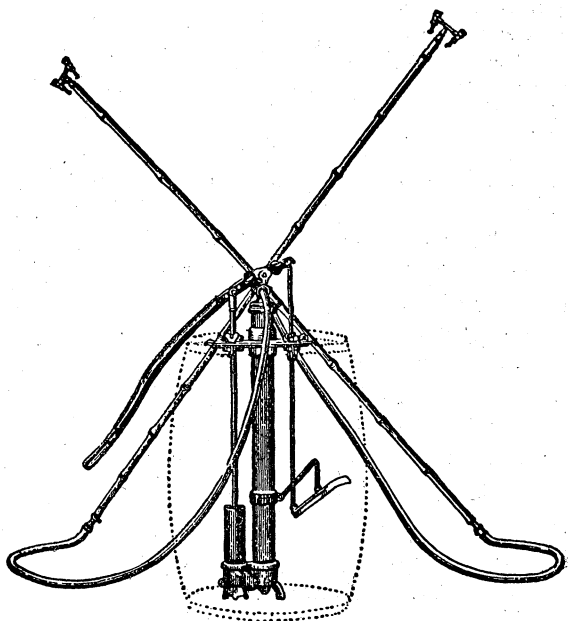


Fig. 3—Showing a good type of barrel outfit.

Dealers in Lime are as follows:

Newala Lime Works, Calera, Ala.
 Calera Lime Works, Calera, Ala.
 Keystone Lime Works, Calera, Ala.
 Longview Lime Works, Calera, Ala.

Wholesale Sulfur Dealers:

Durr Drug Co., Montgomery, Ala.
 Griel Bros., Montgomery, Ala.
 Jacobs Pharmacy, Wholesale Dept., Atlanta, Ga.
 Mobile Drug Co., Mobile, Ala.

Manufacturers of Spraying Machinery:

Morrill and Morley, Benton Harbor, Mich.
 (G. W. Barnett Hardware Co., Agent, Montgomery, Ala.)

Goulds Mfg. Co., Seneca Falls, N. Y.
 (Beck and Gregg Hardware Co., Atlanta, and
 Ala. Machinery and Supply Co., Montgomery, Agents).

The Deming Co., Salem, Ohio.
 Frost Insecticide Co., Arlington, Mass.
 (W. B. Douglass Co., Mr. Turner, Birmingham, Agent).

Dayton Supply Co., Dayton, Ohio.
 F. E. Meyers & Bro., Ashland, Ohio.
 Agencies—Barney-Cavanaugh Hardware Co., Mobile, Ala.
 Selma Hardware Co., Selma, Ala.
 Ala. Machinery and Supply Co., Montgomery, Ala.

Cushman Power Sprayer Company, Lincoln, Nebraska.
 Peerless Power Sprayer, American Sprayer Company of
 Minneapolis, Minn.

Beck Power Sprayer Co., Lansing, Mich.
 H. L. Hurst Mfg. Co., Canton, Ohio.
 E. H. Childs & Co., Ithaca, N. Y.
 Hardie Mfg. Co., of Hudson, Mich.
 Champion Mfg. Co., Pontiac, Mich.