

Oregon Agricultural College Extension Service

O. D. CENTER
Director

Extension Bulletin 193.

Corvallis, Oregon.

February, 1918

DEPARTMENT OF BOTANY AND PLANT PATHOLOGY AND
DEPARTMENT OF ENTOMOLOGY

Oregon Agricultural College and United States Department of Agriculture, Cooperating

SPRAYING APPLES AND PEARS*

By H. P. Barss and A. L. Lovett

INTRODUCTION

The purpose of spraying is not to cure a tree of the effects of a disease or pest by which it has already been attacked. It is rather to coat all the susceptible parts of the tree or fruit with a fungicide or insecticide, so that the fungus or insect can make its attack at no spot that is not already protected by a layer of fatally poisonous material, or to kill the pest or parasite by hitting it with the proper solution at a stage when it is unprotected.

It is evident that spraying cannot be effective unless adapted to the life-habits of the parasite and the conditions of the tree and fruit. Yet many growers apply sprays uselessly at times when the parasite cannot be destroyed, or when protection is of no value, while, at the critical periods of active infection or attack, spraying is omitted. Other growers fail to do the work thoroughly enough to reach all insects, or coat all susceptible parts of the tree. Still others use wrong materials.

Not all orchard troubles can be controlled by sprays. There are plant diseases and insect pests which must be combated in other ways. There are also orchard troubles for which no definite control is yet known.

GENERAL HINTS

Care of the Young Orchard. If free from disease and insect pests when planted, young orchards seldom require any regular schedule of sprays. Thorough inspections should be made, however, at frequent intervals. All kinds of fruits should be watched for the presence of San Jose scale or other scale insects, aphids, borers, bud weevils, fruit caterpillars and Armillaria root rot. In apple orchards look also for mildew, anthracnose, fire blight, and woolly aphis; in pears, for fire blight, slug, and blister mite. When any of the troubles are found, follow out the recommendations outlined for them in the regular spray schedule.

Pruning. Pruning should be conducted in such a way as to let light and air into the interior of the tree. This favors rapid evaporation of moisture from leaf and fruit, and thus tends materially to hinder fungus infections. While pruning, inspect the trees for San Jose scale, woolly aphis, and other pests and diseases. In fire-blight districts, orchardists should be careful constantly to sterilize pruning instruments and cuts.

*Reprinted and revised. First issued March, 1917.

Spray Outfit and Nozzle. An adequate outfit is necessary for good results. The angle nozzle, of the disc type, with a small opening, seems to give the most general satisfaction. In power spraying a pressure of 175 to 225 pounds is needed for best results. The new spray-gun type of nozzle has not been tested out long enough to justify passing final judgment upon it.

Hot, bright weather should be avoided when applying lime-sulfur, because of the burning that often results under such conditions. Self-boiled lime-sulfur is recommended as a substitute under conditions where ordinary lime-sulfur is liable to injure.

Local Variations. The recommendations appearing in this bulletin are adapted as far as possible to the conditions present in the principal fruit-growing sections of the State, but each grower must study his own orchard, the diseases and pests which are prevalent there, and the influence of the climatic conditions of his locality upon them, in order to construct a spraying program to meet most perfectly his own particular needs. This will be especially true for the orchardists east of the Cascades. In case of doubt consult the local fruit inspector, the county agricultural agent, or the Oregon Agricultural College.

DILUTION TABLE FOR LIME-SULFUR

Directions. To make 50 gallons of spray at any dilution indicated below, use the amount of concentrated solution indicated in the column directly under the dilution figure desired and opposite the figure in the left hand column which comes nearest to the test of your stock material, and dilute with water to 50 gallons.

POINTERS ON SPRAY MATERIALS

There is a great variety of commercial spray materials on the market, some of them for general use, many of them for special purposes. Most of these materials are very good when properly used; some are of questionable value when price and purpose are considered, and a few are really dangerous. As a rule the commercial preparations of the various spray materials recommended in this bulletin are standardized, are more convenient to use, and often as cheap as the home-made sprays when the labor and equipment necessary for home preparation are considered. It is important that the material, if a commercial product, be pure and fresh. It should be in the original unopened container and should not have been allowed to dry out or to freeze.

Lime-Sulfur. The expressions "lime-sulfur 1-8, 1-35" etc., mean one gallon of lime-sulfur of the average commercial strength (about 32° Baume) added to eight gallons or thirty-five gallons, etc., of water. For corresponding dilutions with lime-sulfur of different tests consult our Lime-Sulfur Dilution Table. Within reasonable limits, thoroughness of application is of greater consequence than the exactness of dilution.

Arsenate of Lead is prepared in paste form and as a powder. Both are equally effective in the control of insects. The proportions recommended in this bulletin are figured on a basis of the paste form. For example, "lead arsenate 4-100" means lead arsenate paste, four pounds to 100 gallons of the dilute spray solution. In case the powdered arsenate is employed, use only one-half as much as recommended.

Two types of lead arsenate occur, known respectively as the basic lead arsenate (neutral arsenate) or triplumbic, and lead hydrogen arsenate (acid arsenate) or diplumbic. The neutral or triplumbic arsenate

of lead is a more stable compound and is safer to use on tender foliage or in combination sprays where there is a tendency to burn. It is recommended for use when combined with lime-sulfur for application on stone fruits after blossoming time. The diplumbic material has much to render it superior for most poison spray work and is considered safe in combination with lime-sulfur on apple and pear. Commercial lead arsenates are generally the acid or diplumbic unless otherwise branded.

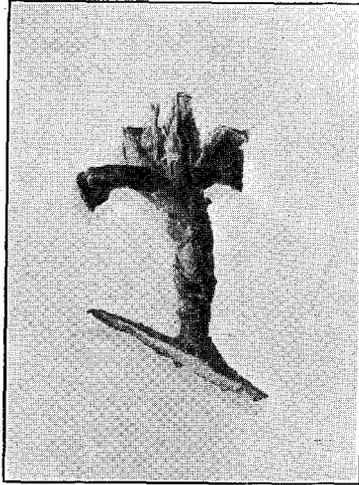
Arsenate of Lime, or calcium arsenate, gives much promise as a substitute for lead arsenate. When used intelligently, it should prove safe and effective. Because of the variations in the constituents of the commercial calcium arsenates, growers contemplating their use in the orchard are strongly advised to submit samples to the Oregon Experiment Station for analysis, and for advice on the proper dilution, and the exact procedure in preparing the solution.

Nicotine as recommended in this bulletin refers to the concentrated nicotine sulphate, 40 percent solution. A strength of 1-1200, which is equal to one pint in 150 gallons, is sufficiently strong for most troubles; frequently higher dilutions are possible. Soap or lime-sulfur improves the spreading and killing powers of the nicotine solution.

Oil Sprays. The use of oil emulsions for the dormant spray has not been generally recommended or practiced in Oregon. It is apparent that for certain insect troubles they are superior to other sprays, and they are probably of equal value with the standard lime-sulfur as a dormant insecticide for scale, red spider mite, etc. Limited observations indicate that an occasional application of oil spray has a beneficial effect in softening and smoothing the bark and producing a generally stimulating effect on the tree. The action of an oil spray is comparatively slow and where rain follows within six or eight days after the application, the effectiveness is materially decreased. Particular care should be taken, therefore, to apply the oil during settled weather.

Test of Stock solution.		Recommended dilutions (on basis of 32° Baume as standard)									
Baume Test.	Spec. Grav.	1-8		1-20		1-30		1-40		1-50	
		Gallons.	Pints	Gallons.	Pints	Gallons.	Pints	Gallons.	Pints	Gallons.	Pints
35	1.318	5		2	2½	1	4	1	¾		7
34											
33											
32		5	4½	2	3	1	5	1	1¾		7¾
31	1.250										
30											
29		6	2	2	5	1	6	1	3	1	¾
28											
27	1.218										
26		7	1	2	7½	2	¾	1	4¼	1	2
25											
24											
23	1.188	8	2½	3	2½	2	2½	1	6¾	1	3½
22											
21											
20		10		3	4¾	2	6	2	½	1	5½

SPRAY PROGRAM I



Delayed Dormant Spray.

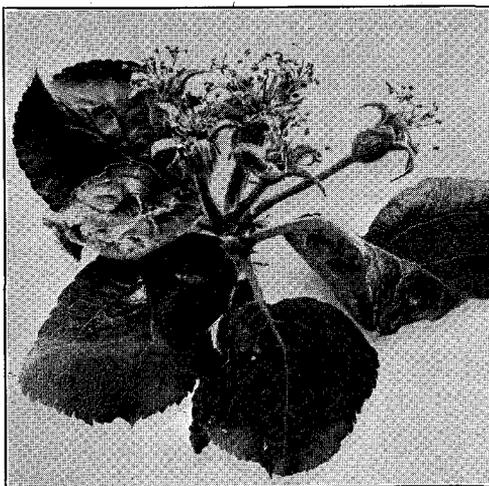


Pink

With very few exceptions, the regular spray program as recommended for the
Frequent orchard inspections should be made, and where other pests and diseases

Application.	Time Applied.	Pest or disease and materials to use.
1. Dormant Spray.	As the winter buds are swelling and before they open.	For San Jose Scale, Red Spider Mite, and Blister Mite (Pear): Use lime-sulfur, 1-8 or miscible oil, 1-17. For Leaf Roller*: Use miscible oil, 1-17.
2. Delayed Dormant Spray.	Soon after winter buds open. Leaves or green parts on fruit spurs about $\frac{1}{3}$ to $\frac{1}{4}$ inch long.	For Scab*: Use lime-sulfur, 1-30. For Aphids: Add nicotine, 1-1200. For Bud Moth: Add arsenate of lead, 4-100.
3. Pink or Pre-blossom Spray.	When the blossom buds are well separated in the cluster, just before opening.	For Scab: Lime-sulfur, 1-40. For Bud Moth and Leaf-Roller: Add arsenate of lead, 4-100.
4. Calyx Spray.	Just as last petals are falling and before calyx closes on the main bud of each cluster.	For Scab: Lime-sulfur, 1-40. For Codling Moth (apples only): Add arsenate of lead, 4-100.
5. Ten-day Spray.	Ten days or two weeks after the calyx application.	For Scab: Use lime-sulfur, 1-40 or 50, (or self-boiled lime-sulfur, 8-8-50, if burning is feared.) For Pear Slug: Add lead arsenate, 4-100.

APPLES AND PEARS



Calyx Spray.

Control of apple scab and codling-moth should be followed in the bearing orchard, and, the proper applications for their control should be given.

Application.	Time Applied.	Pest or disease and materials to use.
6. Thirty-day Spray.	Four or five weeks after the calyx application.	<p>For Scab*: Use lime-sulfur, 1-50, (or self-boiled lime-sulfur, 8-8-50, to prevent burning.)</p> <p>For Codling Moth*: Add arsenate of lead, 4-100.</p> <p>For Green and Woolly Aphis: Use Nicotine, 1-1200.</p>
7. July Spray.	July 10 to 25 depending on locality and season.	For Codling Moth* (second generation): Use arsenate of lead, 4-100.
8. August Spray.	August 5 to September 5, depending on season and locality.	<p>For Codling Moth*: Use arsenate of lead, 4-100.</p> <p>For Anthracnose and Late Scab: Add Bordeaux mixture, 4-4-50, or Burgundy mixture, 2-3-100.</p>
9. Fall Spray.	Late October or immediately after fruit is picked.	<p>For Anthracnose: Use Bordeaux, 6-6-50, or lime-sulfur, 1-8.</p> <p>For Pear Leaf Blister Mite* and Scale: Use lime-sulfur, 1-8.</p>

* when a pest or disease is marked with an asterisk (*), see special discussion regarding it on the pages following.

IMPORTANT POINTS ABOUT PARTICULAR PESTS AND DISEASES

NOTE: Do not waste poison by spraying for pests or diseases not present in your orchard.

Apple Scab. Dormant sprays are of no value against scab. In Oregon the Delayed Dormant Spray (No. 2) **must be given** as the first scab spray to prevent early infections from giving the disease a bad start in the orchard. A thorough covering of foliage, blossom-buds, and fruit by two applications before, and two after bloom, will often result in such a complete elimination of scab that a fifth spray will not be necessary. This spray, however, should not be omitted unless a careful inspection has shown practical absence of scab from both foliage and fruit.

Lime-sulfur will burn through scab spots already present on leaves, and not infrequently, under ordinary spring conditions, will cause, even on healthy leaves, a slight edging and tip-burn, of little real importance. Periods of hot weather, however, are conducive to fruit-burn and more severe foliage injury. At such times the use of self-boiled lime-sulfur is suggested.

Pear Scab. This disease is similar to apple scab and the same applications as for apple scab are recommended. Some varieties, however, are extremely susceptible to lime-sulfur injury and weaker dilutions of this material are suggested. In fact, on the sorts most liable to spray injury, the use of self-boiled lime-sulfur beginning with the calyx spray would be advisable. The addition of resin-oil-soap-spreader to this material will greatly increase its covering power. If scab is to be successfully controlled on the worst affected varieties, it is imperative that the early sprays be applied on time and with the greatest possible thoroughness.

Fire Blight. While scab may destroy an entire crop, fire blight may destroy the entire orchard. It is the most dangerous disease of the apple and pear known and must be watched for unceasingly, so that just as soon as the first case makes its appearance in any orchard or neighborhood, the proper steps may be taken immediately toward its eradication. Taken in time, the disease can be controlled without much trouble or expense, but if it once becomes established in the orchard, it can be eliminated only after a long, hard fight and considerable outlay of cash.

In cases of suspected fire blight, send specimens at once to the Agricultural Experiment Station at Corvallis for microscopic examination, and get in touch with your county fruit inspector or agricultural agent. Do not attempt to cut out blight until you have received careful directions from a reliable source. It is highly contagious and may easily be spread by persons who do not understand the disinfecting process.

Do not be duped into using so-called **Blight cures**. Many orchards have been ruined because owners have unwisely put their trust in some reputed "expert" or in some "remedy" backed up by fine testimonials. Send for our circular on Fire Blight.

Apple Tree Anthracnose. Infections on fruit and branches start in the fall during the rainy spells. To clean up a badly attacked orchard an application should be given in August or early September, followed by another immediately after picking time. Bordeaux used late in the summer on red fruits will cause mottling, and consequently at this time

Burgundy is suggested as a substitute on such varieties. When well under control, a single thorough spraying just after picking season will perhaps be sufficient to keep the disease within bounds.

Mildew. This disease begins to attack the new growth as soon as the winter buds open. Prune out all affected tips before spring. Write the College for special information on the spring and summer treatment for powdery mildew.

Moss. Winter sprays at full strength applied during the dormant season will usually kill the worst cases of moss, if the moss is thoroughly saturated with the fungicide. Bordeaux, lime-sulfur and oil emulsions will do the work. Orchards regularly sprayed for scab during the spring do not usually require any special spray for moss.

San Jose Scale. This manifests itself as small, ash-gray or blackish, pimple-like scales clustered on the bark. Removing scale discloses a flattened, oily, lemon-yellow insect beneath. The bark is thin, and stained with purple, the trees becoming bark-bound and devitalized. Infested fruit shows bright red spots.

Use Spray No. 1. While this spray may be applied practically any time during the dormant season, it would appear that the maximum efficiency is obtained when the treatment is delayed until the buds are swelling well. Application for control is advisable only when one is reasonably sure of presence of pest. Thoroughness is essential; drive the spray under the buds. Oil emulsions are also effective, and are probably occasionally advisable as a substitute for lime-sulfur because of their beneficial effect on the tree. Send for circular.

Red Spider Mites. Use Spray No. 1. Application is advisable only when one is reasonably sure of presence of pest. Send for circular.

Codling Moth. Use Sprays No. 4, 6, 7, and 8. The exact date for the application of Sprays No. 6, 7, and 8 will vary with the season and with the locality. In the case of No. 6 the date of application should correspond with the first deposition of eggs. Procure a standard thermometer and take daily readings at 8:00 p. m. during the season immediately following the calyx application. When the evening temperature registers 60 degrees or above, it is time to apply this spray. As a general rule, this date will follow the calyx spray by about three and one-half to four and one-half weeks in Eastern and Southern Oregon; four to five weeks in the Hood River Valley; and five to six weeks in the Willamette Valley. In a bearing orchard, it is never advisable to omit this spray.

As a general rule, except in districts where the codling moth has been particularly bad the previous season, one summer application is usually sufficient to control the second generation. The time of application, where a single spray is given, will be approximately halfway between Sprays 7 and 8. Where possible, if in doubt, consult the fruit inspector, county agent, or some official who is in a position to know when to apply this summer spray. The time will necessarily vary with the season, locality, and local conditions. In Southern Oregon the rule is, "Keep the fruit covered with spray." Send for circular.

Aphids or Plant Lice. Nicotine sulfate, 40 percent, added to Spray No. 2, at the rate of two-thirds pint to 100 gallons of the dilute spray, is the standard application for control of plant lice. As aphids are nearly always present in the orchard, this application is generally advisable. Reinfestation may take place in June, in which case, add nicotine to Spray No. 6. Send for circular.

Bud Moth. Applications are advisable only where pest has done injury during the previous season. Add lead arsenate, 4-100, to Sprays No. 2 and 3. Send for circular.

Blister Mite. This is usually serious only on pears. Use Spray No. 1, and be very thorough in applying it. The sprayed trees should appear as if whitewashed. The ideal control for blister mite is a spray applied in the fall (see Spray No. 9). When thoroughly done, one application in three years is generally sufficient for satisfactory control.

Pear Slug. Use Spray No. 5, adding lead arsenate, 4-100. Road dust, air-slaked lime, sulfur, or any finely divided powder applied as a dust is also very effective. Send for circular.

Leaf Rollers. Use miscible oil emulsion recommended in Spray No. 1. For maximum efficiency, apply during a period of settled weather. This pest is most common in Northern and Eastern Oregon. Application is advisable only where one is reasonably sure of presence of pest. Write for circular.

Woolly Apple Aphis. This occurs as clumps or masses of cotton-like patches about wounds, cracks, and galled areas of bark, or on water sprouts and exposed rootlets. Beneath this cottony mass are wriggling colonies of soft brown aphids. When thoroughly established, this is a very serious pest in apple trees. Mark infested trees for special treatment and obtain circular giving information for control.

Borers. They never attack perfectly healthy trees; are not controlled by sprays, but require special treatment. Send for circular.

THE DUSTING METHOD

It has not yet been demonstrated that fungicides and insecticides applied in dust form are thoroughly effective for the control of all insect pests and fungus diseases. Some pests and diseases can doubtless be controlled by the dusting method, but the experiences of experiment stations and practical growers do not yet appear to justify an unqualified general recommendation of this method.

NOTICE

More complete information on particular pests and diseases, and also directions for making any particular spray material, may be secured by writing to the Oregon Agricultural College at Corvallis. If information is desired regarding the identity of any insect or disease, send complete description, together with specimens of insect or disease and of the affected plants, if possible. Wrap the material in a container which will not be crushed in the mails. Put your name and address on the package.

Unsafe Combinations. The combinations of sprays recommended in this bulletin are safe under ordinary conditions. Regarding combinations not referred to here, consult the Oregon Agricultural College.