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Spraying Stone Fruits

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INTRODUCTION

The object of this bulletin is to give the fruit grower, in condensed form, such information as will assist him to combat the pests and diseases in his orchard with the right materials, at the right time, and in the right way. The recommendations are based upon the most recent available results of experiments and studies carried out in Oregon or of those conducted by reliable workers elsewhere and adapted to Oregon conditions.

PURPOSE OF SPRAYING

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.

EFFECTIVENESS

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 peach orchards look also for leaf curl, mildew, blight, and twig miner; in prunes and plums for leaf spot, spider mites, bark beetles and borers; in cherries, for bacterial gummosis, leaf spot, slug, and shot-hole borer. 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 not only facilitates spraying but also favors rapid evaporation of moisture from leaf and fruit and thus tends materially to hinder fungous infections. While pruning, inspect the trees for San Jose scale, woolly aphid, and other pests and diseases. Remove all mummied fruits from the orchard. Where bacterial gummosis is present always sterilize pruning instruments and cuts with some good disinfectant like one percent lysol to prevent spreading the disease.

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.

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.

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 apples and pears. Commercial lead arsenates are generally the acid or diplumbic unless otherwise branded.

Nicotine as recommended in this bulletin refers to the concentrated nicotine sulfate, 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.

Resin-Oil-Soap Spreader. This inexpensive material greatly increases the covering power of Bordeaux and self-boiled lime-sulfur. Send for directions for making. Its use is not advised with ordinary lime-sulfur.

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

Ordinary Lime-Sulfur Solution, when used in warm weather, even as dilute as 1 to 45, has caused severe injury to the foliage of prunes and sometimes to fruit. It is very injurious to peach foliage also.

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 fungous 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.

SPRAY PROGRAM FOR PRUNES AND PLUMS

Application.	Time Applied	Pest or disease and materials to use
1. Dormant Spray.	Just as the winter buds are opening.	For San Jose Scale, Red Spider Mites and Twig Miner: Use lime-sulfur, 1-8.
2. Pre-blossom Spray.	When the blossom buds are showing white just before opening.	For Brown Rot* Blossom Blight: Use Bordeaux, 4-4-50 or lime-sulfur, 1-30. For Bud Moth: Add lead arsenate, 4-100. For Aphids: Add nicotine, 1-1200.
3. First Fruit Spray.	As soon as the "shucks" or calyx parts are off the fruit.	For Brown Rot and Leaf Spot*: Use Bordeaux, 4-4-50 or self-boiled lime-sulfur, 8-8-50, with resin-soap spreader. For Syneta: Add neutral or triplumbic lead arsenate, 7-100.
4. June Spray.	About June first.	For Leaf Spot (Beneficial for brown rot also): Use Bordeaux, 4-4-50 or self-boiled lime-sulfur, 8-8-50 with spreader.
5. July Spray.	About July first.	For Leaf Spot (Beneficial for brown rot also): Use same materials as in preceding.
6. August Spray.	About one month before picking time.	For Brown Rot*: Use Bordeaux, 4-4-50 or self-boiled lime-sulfur, 8-8-50. Add resin-soap spreader.

SPRAY PROGRAM FOR PEACHES

Application	Time Applied	Pest or disease and materials to use
1. Dormant Spray.	At least two weeks before buds begin to open.	For Peach Leaf Curl*: Use Bordeaux, 6-6-50 or lime-sulfur, 1-8. For San Jose Scale. Use lime-sulfur, 1-8.
2. Late Dormant Spray.	Just as first buds are ready to open.	For Peach Twig Miner, Red Spider Mite: Use lime-sulfur, 1-12. For Aphids: Add nicotine, 1-1200. For Bud Moth: Add lead arsenate, 4-100.
3. First Fruit Spray.	Just after the "shucks" or calyx parts fall off.	For Peach Blight* on fruit and leaves: Use self-boiled lime-sulfur, 8-8-50. (Many growers use Bordeaux, 4-4-50 with excellent results.)

*See special discussion on this particular pest or disease.

SPRAY PROGRAM FOR PEACHES—Continued

Application	Time Applied	Pest or disease and materials to use
4. Second Fruit Spray.	About two or three weeks after the preceding.	For Peach Blight on fruit and leaves: Use self-boiled lime-sulfur, 8-8-50.
5. Last Fruit Spray.	About one month before picking.	For Brown Rot: Use self-boiled lime-sulfur, 8-8-50. For Bud Moth and Peach Twig Miner: Add lead arsenate, 3-100.
6. Early Fall Spray.	As soon as the fruit is picked.	For Peach Blight, twig and bud infections: Use Bordeaux, 4-4-50.
7. Late Fall Spray.	About the first of November.	For Peach Blight, twig and bud infections: Use Bordeaux, 6-6-50.

SPRAY PROGRAM FOR CHERRIES

Application	Time Applied	Pest or disease and materials to use
1. Dormant Spray.	Just as the winter buds are beginning to open.	For San Jose Scale and Red Spider Mite: Use lime-sulfur, 1-8. For Aphids: Add nicotine, 1-1200, and apply Tanglefoot in band around trunk to prevent ants carrying aphids up the tree.
2. Pre-blossom Spray.	When blossom buds show white just before they open.	For Brown Rot Blossom Blight*: Use Bordeaux, 4-4-50, or lime-sulfur, 1-30. For Bud Moth and Syneta: Add neutral or triplumbic lead arsenate, 7-100.
3. First Fruit Spray.	As soon as most of the "shucks" or calyx parts have fallen.	For Leaf Spot* and Brown Rot: Use Bordeaux, 4-4-50, or lime-sulfur, 1-50, or self-boiled lime-sulfur, 8-8-50. For Syneta: Add neutral or triplumbic lead arsenate, 7-100.
4. Second Fruit Spray.	Apply a month before picking time.	For Brown Rot and Leaf Spot: Use Bordeaux, 4-4-50, or self-boiled lime-sulfur, 8-8-50, or Burgundy mixture, 2-3-100. For Slug: Add neutral or triplumbic lead arsenate, 6-100.
5. July Spray.	After the fruit is picked or about first of July.	For Leaf Spot: Use Bordeaux, 4-4-50, or self-boiled lime-sulfur, 8-8-50
6. August Spray.	About the first week in August.	For Cherry Slug and Bud Moth: Use lead arsenate, 3-100.

*See special discussion on this particular pest or disease.

IMPORTANT POINTS ON PARTICULAR PESTS AND DISEASES

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

Brown Rot of Stone Fruits. This is the worst disease of prunes in Oregon, frequently destructive to cherries and sometimes bad on peaches. It varies tremendously in severity from year to year. It often causes considerable damage in prunes and cherries by blossom blight. Attacks of fruit rot are likely to develop at any time during the season when there is continued moisture, particularly when accompanied by warm temperatures. A rigid spray schedule, therefore, cannot be adhered to. The worst attacks occur almost always during the ripening and picking period. Hence it is usually very desirable to give a thorough spraying about a month before picking. Other sprays should be given when conditions seem to justify them. Send for our mimeographed circular on brown rot.

Leaf Spot or Yellow-Leaf Disease of Prunes and Cherries. Caused by a fungus known in its summer stage as *Cylindrosporium*. Results in dropping of leaves; this, if severe, brings about poor fruit development, retarded growth and reduced or weakened fruit buds. Experiments at Salem conducted by the Experiment Station in 1916, proved that spraying will practically eliminate the disease. Attacks vary greatly in severity from year to year. Hence growers are advised to watch and spray when first signs of the disease are evident. Send for circular.

Leaf Roll and Internal Browning of Prunes. These two troubles are exceedingly common in seasons of long-continued warm and dry weather. Neither appears to be caused by any parasitic disease or pest. Consequently, spraying can be of no direct value. Shallow rooting, dry soils, and dry weather combine to produce the worst effects. The internal browning or breaking down of the fruit begins at the pit and may extend outward till it involves the whole flesh. This has been confused with the fungous brown rot. It is often associated with the leaf roll. Keep the moisture supply as abundant and uniform as possible throughout the season.

Peach Blight. Infections take place abundantly during fall rains and cause the death of buds and girdling of twigs during the winter. Then in the spring new infections attack fruit and foliage, causing fruit spot and leaf shot-hole. The first fall spray should be given before rains begin. All buds and twigs should be thoroughly coated. Use resin-soap spreader with the Bordeaux or self-boiled lime-sulfur to get better covering power.

Peach Leaf Curl. Failure to control this disease seems to come from two causes; spraying too late and not spraying thoroughly enough. Infections take place just as the leaves are emerging. The one spray needed must be applied before any of the leaf tips are out. Every bud and twig must be thoroughly covered with the spray, not an easy task. Experiments conducted by the Experiment Station appear to indicate that leaf curl may be controlled by a single winter application even as early as the first of December.

Powdery Mildew of Peaches. The first control applications should be given soon after the winter buds have come out and while the leaves are still very small; repeat at intervals of three or four weeks until mildew is eliminated and give another spray if it begins to show again. Use self-boiled lime-sulfur 8-8-50 with resin-oil-soap spreader added. In the warmer weather of late spring or early summer dusting with very finely powdered sulfur should be effective.

Bacterial Gummosis. This disease is common and destructive on young sweet cherries, and sometimes troublesome on other stone fruits in Western Oregon, but is apparently unknown east of the Cascades. It cannot be controlled by spraying. Send for circular.

Moss. Winter sprays at full strength applied during the dormant season will usually kill the worst case of moss, if the moss is thoroughly saturated with the fungicide. Bordeaux, lime-sulfur, and oil emulsions will do the work. Orchards regularly sprayed 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 Mite. Use Spray No. 1. Application is advisable only when one is reasonably sure of presence of pest. Send for circular.

Aphids or Plant Lice. The addition of nicotine sulfate, 40 percent, as indicated, at the rate of two-thirds pint to 100 gallons of the dilute spray is the standard application for plant lice. As aphids are nearly always present in the orchard, this application is generally advisable. In the case of cherry trees ants carry aphids up to reinfest the tree. Band the tree with tanglefoot or other material to prevent this.

Fruit Tree Leaf Syneta. This is a small, elongate, active, creamy-white beetle. Feeds on buds, unfolding leaves, blossom petals, and developing fruit, making unsightly holes. Use the neutral or triplumbic arsenate of lead, 7-100, in sprays as indicated.

Bud Moth. This is a chocolate-brown worm one-third inch long, found in a mass of webbed leaves at tip of twig.

Add neutral lead arsenate, 7-100 to Spray No. 2. Application is advisable only where pest has done injury the past season. Send for circular.

Cherry Slugs. These are greenish-brown, slimy, slug-like larvae, which skeletonize foliage of cherry and pear. Use Spray No. 4, adding neutral or triplumbic arsenate of lead, 6-100. Road dust, air-slaked lime, sulfur, or any finely divided powder applied as a dust is also very effective. Send for circular.

Cherry Fruit Maggot. This is a small, white, cylindrical maggot found feeding inside the fruit. If lead arsenate sprays are applied for the control of cherry slug, they will also ordinarily control the maggot. If it is desired to apply a special spray, use lead arsenite, 3-50, plus 2 gallons of cheap sirup. This should be applied at the rate of one pint to the tree. Use a hand pump throwing a fine misty spray which will deposit minute droplets on the outer leaves. This is to poison the fly which produces the maggot. Treat the trees just as the fruit begins to color well. Write for circular.

Peach and Prune Twig Miner. This is a chocolate-brown worm $\frac{1}{4}$ inch in length found in tunnels at the base of a wilted tip or fruit spur. Summer applications are ineffective. Use spray indicated. Applications are generally advisable as the pest is usually present. Send for circular.

Borers. These are not controlled by sprays. They require special treatment. Send for circular.

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.

LIME-SULFUR DILUTION TABLE

To make 50 gallons of dilute spray use the quantity of concentrated lime-sulfur indicated and dilute with water to 50 gallons.

Hydrometer Test of Stock Solution		Dormant Spray	Early Spring Spray (1-30)	Mid Spring Spray (1-40)	Late Spring Spray (1-50)
Baume Scale	Specific Gravity	(1-8)			
34°	1.304	5 gal.	1 gal. 4 pts.	1 gal.	7 pts.
32°	1.282	5 gal. 4 pts.	1 gal. 5 pts.	1 gal. 1 pts.	1 gal. (scant)
30°	1.260	6 gal.	1 gal. 6 pts.	1 gal. 2 pts.	1 gal. $\frac{1}{2}$ pt.
28°	1.329	6 gal. 4 pts.	1 gal. 7 pts.	1 gal. 3 pts.	1 gal. 1 pt.
26°	1.218	7 gal.	2 gal.	1 gal. 4 pts.	1 gal. 2 pts.
24°	1.198	8 gal.	2 gal. 2 pts.	1 gal. 6 pts.	1 gal. 3 pts.
22°	1.179	9 gal.	2 gal. 4 pts.	1 gal. 7 pts.	1 gal. 4 pts.
20°	1.160	10 gal.	2 gal. 6 pts.	2 gal. (plus)	1 gal. 5 pts.