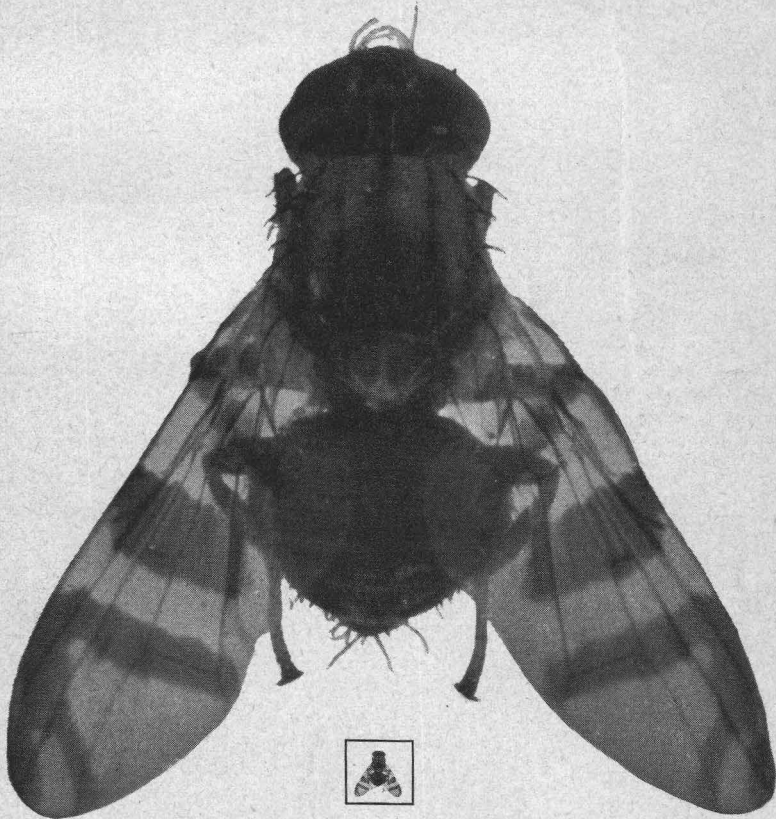


Spray Program
for
OREGON STONE FRUITS



Cherry fruit fly, greatly enlarged. (Insert shows natural size.)

Oregon State System of Higher Education
Federal Cooperative Extension Service
Oregon State College
Corvallis

Spray Program for

OREGON STONE FRUITS

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INSECT PESTS OF STONE FRUITS

San Jose scale manifests itself as small, ash-gray or blackish pimplelike scales clustered on the bark. The bark usually shows a purple stain for a short distance around each scale especially on young trees and new growth. The trees become bark-bound and devitalized. Infested fruit shows bright red spots. The pest seldom becomes serious in well-sprayed commercial orchards. Where present, the dormant spray of lime sulphur or oil is recommended.

Lecanium, or soft-bodied scale occurs as a rather large, dark-brown, strongly humped scale on the limbs and twigs of stone-fruit trees. The standard method of control is to apply an oil-emulsion spray (4 per cent actual oil) in the early spring as the winter buds are beginning to swell. Injury may occur if oil sprays are used after buds start to open.

Mites. Several species of mites, the European red mite, brown orchard mite, the common or two-spotted spider-mite, Willamette mite, and the rust mite attack Oregon orchards. Mites are more frequently serious on prune and cherry where no spray program is regularly applied. The first two species overwinter in the egg stage on the tree. A dormant spray of 3 per cent petroleum oil controls these two species. The common red spider-mite, however, cannot be controlled by a dormant or delayed dormant spray since it migrates to the orchard from adjacent weeds and other plants later in the season. Summer sprays of oil emulsion or lime sulphur are recommended. Lime sulphur, 1 to 2 gallons plus 5 pounds wettable sulphur mixed with 100 gallons of water, is the standard summer lime-sulphur spray for mites. On peach trees not more than one gallon of liquid lime sulphur should be used in 100 gallons of spray. A "summer" oil emulsion, 1 to 2 gallons to 100 gallons of water, is of value when used as a summer spray for spider control. See page 11 for discussion of oil sprays. Dusting with sulphur is sometimes effective.

Prune thrips. These tiny insects, about 1/20 inch long, come from the ground in the early spring, about March 15 to 20, as the buds are swelling and opening. These insects work into the buds before they open and in parts of western Oregon have caused serious bud injury. Later the adults lay eggs in stems of the fruit and leaves and also in the fruit. Both young and adults may feed on the young prune, rasping the tender surface causing a rough russetlike corky condition of the skin. A carefully timed spray of lime sulphur, 3 gallons, plus nicotine sulphate, 1 pint to 100 gallons, has proved effective on prunes. One or two sprays are given. The time and number of spray applications depend on

the emergence of the thrips: (1) usually when winter buds are swelling and a few green tips are showing, and (2) when most of the buds are green at the tip. In some seasons, due to the late emergence of the thrips, the first spray is applied in the green-tip stage followed by a second spray applied as a preblossom spray. Possibly similar applications might be of value in the control of thrips on cherries. At least 250 pounds pressure and thoroughness in application are essential in thrips control.

Peach and prune twig miner. This small, pinkish worm works havoc by tunneling into the terminal growth of both bearing and nonbearing peach, prune,

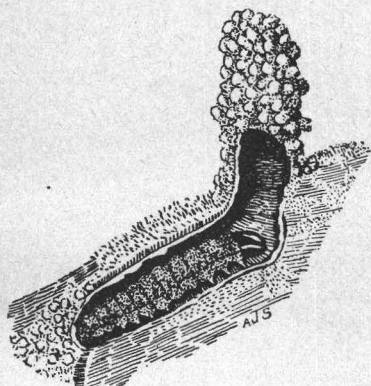


Figure 1. Peach twig miner larvae at rest in the hibernating burrow.

and apricot trees. In recent years a later brood of worms has attacked the fruit also. Mature peaches and apricots have shown an alarming degree of infestation, and a heavy prune drop has sometimes resulted from the attack of the worms. The pest is almost invariably present in destructive numbers in both young and bearing orchards. Lime sulphur, 12 to 100, or even 10 to 100, applied any time from late February until early pink, has been the standard recommendation for peach twig borer for many years. Recent observations show that this spray of lime sulphur applied after the buds begin to open is likely to cause injury and also may not be as effective in combating the twig borer as it formerly was thought to be.

Dry basic lead arsenate, 3 pounds in 100 gallons of water, applied in the late dormant or preblossom stage is recommended. Oil sprays are not recommended.

Bud moth. This is a chocolate-brown worm $\frac{1}{2}$ inch long found inside a mass of webbed leaves at the tip of the twig. It attacks all fruit trees, but owing to arsenate sprays for other pests on apple and pear, bud moth is rarely serious there. Cherries are often seriously attacked, and other stone fruits to a varying degree. Lead arsenate in the preblossom spray will control. See remarks on lead arsenate on stone fruits, page 9.

Aphids or plant lice occur as small green or black, soft-bodied insects on the developing buds and leaves. They have piercing mouthparts and suck the juices from the leaves, sometimes causing dwarfing, cupping, and curling. The standard aphid spray is a nicotine-sulphate solution applied as recommended in the Spray Program.

Syneta leaf beetle. This insect occurs in April and May on foliage, fruit clusters, and in open blossoms as a creamy-white beetle about $\frac{1}{4}$ inch long. It eats holes in the leaves and blossom petals and gnaws out small cavities in fruit and fruit stems. The syneta beetle is especially injurious to cherry. A satisfactory spray on cherries has not as yet been developed, but in tests conducted by the Oregon Agricultural Experiment Station, 4 pounds of lead arsenate plus 4 pounds of lime to 100 gallons of water, applied both as a preblossom spray and also when most of the petals have fallen, has given a fair degree of control. Help in brown-rot blossom-blight prevention may be obtained by combining

bordeaux mixture 6-6-100 (see page 10), with the lead arsenate spray for syneta beetle. If lead arsenate is added to bordeaux, lime is not needed. Applications of lead arsenate-lime dust (30-70) instead of the spray applications have given control on cherries in the Marion-Polk area.

The western 12-spotted cucumber beetle has become a serious pest of peaches in Oregon. Irregular-shaped pits are eaten in the green and ripening fruit. Damaged fruit normally rots, causing complete loss of the injured fruit. This insect is difficult to control. Frequent applications of a 1 per cent rotenone dust or a pyrethrum dust containing .3 per cent pyrethrins is recommended. The dust is applied in early morning when the air is calm. Thorough coverage is necessary, since both rotenone and pyrethrum kill by contact. The first application of dust is made when the first injury occurs and subsequent dustings are made as the beetles continue to migrate into the orchards.

Shot-hole borers are small, dark-brown beetles $\frac{1}{8}$ inch long. Their presence is made known by the small "shot hole" tunnels through the bark. Shot-hole borers seldom attack perfectly healthy trees, but usually those that have a "devitalized" condition. The larva of this beetle feeds on a certain fungus which grows only when the trees are in this condition. Poor drainage, lack of cultivation, winter injury, etc., may cause the devitalized condition. The first step in control is to get the trees back into a healthy condition. Seriously infested trees or limbs should be cut out and burned.

For slightly infested trees the following wash is effective: water, 3 gallons; soft soap, 1 gallon; crude carbolic acid, $\frac{1}{2}$ pint. This is mixed and painted over the infested portions during April or May. About three applications are advised at weekly intervals.

Fruit-tree bark beetle has recently been discovered in Oregon. The presence of this insect also is made known by small shot-hole tunnels through the bark. The larva, however, differs from the larva of the true shot-hole borer in that it makes galleries under the bark as does the adult beetle. The recommendations for control of this pest are: (1) burning prunings; (2) dressing tree wounds; (3) cultural practices that will stimulate tree growth and aid in prevention and control of the ravages of this pest.

Flat-headed borers are slender, white grubs with broad, flattened heads. They are found generally just beneath the bark where they tunnel out broad, flattened channels. The bark of the tunnels is usually discolored and shrunken. Young trees are most noticeably injured.

These borers can rapidly deplete and destroy a tree, especially a young tree. Other injuries, such as pruning wounds, sun scald, etc., invite borer infestation. The treating of these wounds with tree paint or whitewash may aid in preventing borer infestation.

Cherry fruit maggot occurs as a small white maggot inside the ripe fruit. The standard spray, applied in the form of a poison bait for the adult fly, is lead arsenate $\frac{1}{2}$ pound, sirup or molasses 2 quarts, water 10 gallons. Three applications are usually given—the first when the adult flies appear (about the time the Royal Anns show slight color, or about June 1 to 10); a second application ten days later; and a third application one week after the second. One spray application is usually sufficient to control this pest on Royal Ann cherries. Later applications should be applied on Royal Anns after the cherries are harvested to prevent migration of the fly to late-ripening varieties of cherries. Rains will discount the effect of previous applications and necessitate a repetition of the spray. The adult fly is about $\frac{1}{4}$ inch long. (See cover picture.)

Recent field tests with a lime sulphur-lead arsenate combination spray gave excellent control of cherry fruit-fly.

Two properly timed cover sprays should suffice to control the fly on all varieties of cherries, unless heavy rains occur during the spraying season. The sprays must be thorough, covering all parts of the trees. The *first* spray should be applied when the first flies appear in the field. This usually occurs during the last week in May or early in June when Royal Ann cherries show only a trace of color. The exact time of emergence may be determined by "emergence cages." Since the flies begin to lay eggs soon after emergence from the soil, there should be no delay in applying the first spray. A *second* spray should be applied at the peak of fly emergence or 2 weeks after the first spray. If a third spray is necessary, it should be applied about 2 weeks after the second spray. (See Oregon Station Circular of Information No. 253.)

The spray should be applied as a thorough *bait* spray, applying the solution as fine droplets to the upper surface of the outer leaves where the adult flies will feed upon it. Seedling trees and adjacent foliage should also receive the treatment. Information on timing of sprays for fruit-fly control is sent out each season from the Oregon Agricultural Experiment Station. Get from Oregon Agricultural Experiment Station or your County Agent, Circulars of Information 185 and 253.

Cherry slug occurs as a greenish-brown, slimy, sluglike larva, which skeletonizes the foliage of cherry. When the insect appears dust with a lead arsenate-lime dust (20 pounds lead arsenate-80 pounds hydrated lime), or spray with one pint of 40 per cent nicotine sulphate to 100 gallons of spray.

Western peach and prune root borer. This serious pest of prune trees is not controlled by spray applications, but special treatment must be given. The paradichlorobenzene treatment is recommended for older trees. The most satisfactory time for this is from August 15 to September 15. Apply $\frac{3}{4}$ to one ounce of the chemical in a circular band an inch or two in width and about two inches from tree trunk. This band is covered with 4 to 6 inches of earth. Tests and observations indicate that it may be used on younger trees without danger to the trees if it is kept at least 2 inches away from the trunk.

DISEASES OF STONE FRUITS

Prune "scab." This blemish has long been known under the name of "Scab." Since it is not caused by a fungus, as are the ordinary scab diseases, the name "Russet" is suggested as more appropriate. The terms "scab" or "russet" are used to refer to any rough, russeted, corky, or scurfy condition of the skin of the prune. Among the suggested causes have been: (1) wind-rubbing of young fruits against branches or leaves, (2) late-frost injury, (3) injury due to "shucks" clinging to the young developing fruit, and (4) feeding of insects such as thrips, syneta leaf beetle, etc. All of these suggested causes are more or less mechanical or physical. It has long been known that late frost will cause a russet which usually completely encircles the fruit. There is also evidence that thrips may cause a certain type of russet. Recent experimental work by the U. S. Department of Agriculture in cooperation with the Oregon Experiment Station indicates that mechanical injury, such as rubbing against branches and leaves in windy weather while the fruits are young, undoubtedly causes a portion

of the so-called "scab" or russet on prunes, although it may not be the only cause of this trouble.

Bacterial gummosis of cherry and other stone fruits causes large trunk and limb cankers and sometimes spur blight on young trees. East of the Cascades the disease is unknown, gumming there being due to other causes. Sprays will not control. Surgical methods are advisable. In cherry orchards where the body and frame-work limbs are of resistant seedling stock, the most serious effects are absent. Seedlings are not always resistant. Send for Circular of Information No. 202, "Bacterial Gummosis of Cherry," which discusses copper nitrate solution as a control.

Brown rot. This disease causes decay of the fruit and blight of blossoms and fruit spurs on apricot, cherry, peach, plum, and prune. Certain varieties of pears are also subject to this disease.

BROWN ROT BLOSSOM BLIGHT OF APRICOT, CHERRY, PEACH, AND PRUNE. This phase of the brown-rot disease is characterized by dead, brown blossoms. Sometimes the infection runs back from the blossoms and kills the fruit spur. It may even spread farther and cause a canker on the branch at the base of the spur. Sometimes these cankers completely girdle and kill small branches. The best single control application is a spray of bordeaux 3-3-50, given just as the first blossoms begin to open. When attacks are severe another spray in full bloom and a third as the petals drop may be warranted. Thorough coverage is essential.

BROWN ROT OF FRUIT. The brown-rot decay of fruit in the orchard is followed by the appearance of a gray dust on the surface of the rotted area. This gray spore dust spreads the disease. The spread varies so much with the weather and with the locality that no fixed program of sprays or dusts will fit all years or all districts.

Brown rot is checked rather effectively and safely by noncaustic sulphur-containing sprays or by sulphur dusts when the weather is warm, preferably 70 degrees or more. Ordinarily lime sulphur in excess of 1 gallon in 100 gallons of water is likely to cause injury in hot spring and summer weather.

Sulphur dust and wettable sulphur sprays are recommended for brown-rot control after the fruit is set, and as the weather gets warmer and drier. Sulphur in any form is not recommended for apricots.

These sulphur fungicides are effective against powdery mildew as well as against brown rot on stone fruits. Wettable sulphur sprays or sulphur dust should be used on growing peaches, cherries, prunes, and plums whenever brown rot begins to show in the orchard regardless of the size of the fruit. If heavy rains follow immediately after brown-rot sprays or dusts are applied, another application is advisable for protection and to replace dusts or sprays washed off.

PREHARVEST SPRAYS AND DUSTS. In recent years certain Willamette valley peach growers have used sulphur dust or wettable sulphur three times previous to harvesting the fruit. The first application is made 5 weeks before harvest followed by a second application 10 days after the first and the third application 10 days after the second. These three sulphur dusts or sulphur spray applications are protection against brown-rot attack. By applying these dusts the grower keeps ahead of brown-rot infection on ripening fruit and there may also be enough sulphur dust on the fruit to carry it through the markets.

Brown-rot control lies in preventing disease from getting a start. There is no cure for brown-rot infected fruit. Keep ahead of brown rot on ripening fruit by dusting or spraying before it makes an attack.

Clean-up measures that remove the blossom-blight twigs and brown-rot mummies in the trees help against infection, but cannot be depended upon alone to control brown rot. Plowing early in the spring and harrowing every week during the blossom period will reduce early attacks by destroying the spore cup forms of the fungus coming from the old mummies in the ground.

Mummies hanging in the trees cause infection and should be removed from the trees and destroyed in the early fall following harvest. Rotted fruit on the ground in the fall should be cleaned up. If feasible, hogs may be used for this purpose.

Pruning trees to open them up to light and air helps in brown-rot control and also makes possible more effective spraying.

Powdery mildew. In some localities powdery mildew may be quite serious on peaches. It is characterized by a whitish coating on twigs and leaves, and by grayish to brownish spots of varying size on the fruits. The mildew fungus lives over winter as whitish scurfy or felty patches on the dormant twigs and buds. Twig infections are especially serious on nectarines.

Probably the most important single control measure consists of an application of winter strength lime-sulphur while the trees are completely dormant. Spring and summer applications of wettable sulphur spray or sulphur dust used for *Coryneum*-blight or brown-rot control should help to control mildew.

Leaf spot of cherry and prune. This disease causes small spotting or speckling of leaves and fruit stalks. It may cause leaves to turn yellow and drop early in the season. Fruit may fail to fill out. This trouble is not found in all orchards. It seems to be worse where trees are crowded or the soil is thin. Since the old leaves carry the disease over winter, they should be plowed under before blossom time. If every old leaf is destroyed, there will be no infection except from outside sources and this would be very slight. Sprays should be applied whenever leaf spot regularly causes loss, following directions in the spray calendar. These sprays also help to control brown rot.

Peach blight. This is the most serious disease of peach trees in the state. It blights the buds and causes cankers on the twigs during the fall and winter and spots the fruits, twigs, and leaves during the growing season. The fall and winter infections on buds and twigs constitute the most serious phase of this disease and if *completely controlled* the disease *would eventually be eradicated*. Bordeaux 8-8-100, applied in the late summer before the fall rains, is an effective protection against fall and winter attacks of bud and twig blight. When the disease is serious and the fall and winter infections on buds and twigs have not been controlled, it may be necessary to spray again in the spring to prevent fruit spot. If this spray is necessary, a wettable sulphur spray should be applied as soon as the shucks drop off the fruits. When prevalent this disease *will quickly ruin an orchard unless control measures are applied* at the right time.

Peach leaf curl. This destructive disease causes thickening and distortion of the leaves, resulting in their eventual death and depleting the vitality of the trees. It can be controlled easily by applying bordeaux 12-12-100 (see page 10) as soon as the leaves are off and preferably not later than December, but in any case the curl spray should be applied **before the buds begin to swell**. When

the curl begins to show on the leaves it is too late to do anything about it. Thorough coverage of every bud is essential. Lime sulphur sometimes produces good results, but bordeaux has proved by far the most reliable material for Oregon.

Mosses and lichens. Fruit trees that are rarely or never sprayed frequently become so covered with mosses and lichens that they are very unsightly and may even be injured by the smothering effect of these growths. When trees are properly sprayed for insect pests and plant diseases there is no trouble from moss or mosslike growths.

If fruit or nut trees are not sprayed regularly for diseases and pests the growth of lichens and mosses may be prevented by a late fall or winter spray of 10-5-100 bordeaux mixture. (See page 10). A driving spray under high pressure should be employed and all the moss and mosslike growths on the branches should be thoroughly saturated.

Little Leaf of stone fruits. Little Leaf, which is prevalent in stone-fruit trees in parts of eastern Oregon, has been controlled with sprays made of 25 pounds of zinc sulphate in 100 gallons of water and applied to the foliage about one month after leaves appear. Later foliage sprays, while beneficial, have not been as helpful. With bearing trees zinc sprays of 50 pounds of zinc sulphate in 100 gallons of water are given just before the buds open in the spring to avoid injury that sometimes occurs to fruit when foliage sprays are applied after fruit sets. Partial defoliation has usually resulted when rains closely followed zinc-sulphate foliage sprays on stone fruits. Weather forecasts may assist growers in avoiding rainy periods when it is found necessary to use zinc-sulphate sprays.

Zinc injections to aged fruit trees, including apple trees, have given control for periods of three years. Zinc injections have benefited walnut trees in the Medford area. Write for Extension Circular 310, "Zinc Treatments for Little Leaf."

IMPORTANT POINTS ABOUT SPRAY MATERIALS

Effective results in spraying depend to a large extent on the use of proper methods of preparing, diluting, and combining sprays. After the spray material has been selected, timing of application and complete coverage are essential for good results. Severe infestations may require a modified spray program different from the schedule outlined in this bulletin. Information from local authorities will assist in making the necessary changes. General information on the preparation of sprays and the proportions to observe in their use may be obtained from Experiment Station Bulletin 393.

Spreaders. Materials used with a fungicide or an insecticide spray to increase the spreading and adhesive properties are often of advantage, but frequently do not increase the fungicidal or insecticidal value. In some sprays, and especially certain combinations of sprays, it is very necessary to use spreaders. These recommendations are given specifically and in more detail wherever they may be used advantageously. Experiment Station Bulletin 393 outlines how various spray materials may be mixed in the spray tank and suggests spreader treatment.

A new class of commercial compounds commonly known as wetting or degumming agents have shown promise as spreaders, especially for sulphur sprays. Two to 4 ounces of the dry powder to 100 gallons of the spray are usually sufficient. These products may be obtained under various trade names.

Combination sprays. It is common orchard practice to combine two or more different spray materials by mixing them in the spray tank and to apply them as a unit. In order to retain as much as possible of the active principle unchanged of each insecticide or fungicide, combinations should be prepared by following a definite procedure. In Station Bulletin 393 are outlined recommended combinations and the order of mixing in the tank.

Lead arsenate on stone fruits. When lead arsenate is referred to both in bulletins and in everyday discussion, the term refers to acid lead arsenate commonly known also as standard lead arsenate. Another form of lead arsenate known as "basic lead arsenate" causes less injury to plants, but is also less toxic to insects. Where this form is recommended for use, as in the late dormant spray for peaches and apricots for bud-moth and twig-miner control, it is designated as "basic lead arsenate." Since the standard lead arsenate as recommended on stone fruits may cause injury, chances for injury may be reduced to a minimum by using 4 ounces of zinc sulphate and 4 ounces of hydrated lime to each 100 gallons of spray. This should be added to the tank just before adding the lead arsenate.

Lime sulphur. The proportions of lime sulphur recommended for sprays in this bulletin are based on the use of the standard concentrated liquid lime sulphur testing about 32° by Baumé hydrometer test. Thus, for example, where the recommendation "lime sulphur 12 to 100" appears in the calendar, use 12 gallons of the standard concentrated liquid lime sulphur and add water to make 100 gallons of dilute spray. When the stock lime sulphur is different from standard strengths, dilute according to the accompanying Liquid Lime-Sulphur Dilution Table. (See page 10.)

Wettable sulphur sprays. Within recent years wettable sulphur substitutes for ordinary liquid lime sulphur and dry lime sulphur have been devised which do not have the caustic or burning action of lime sulphur and hence are safer to use on tender-skinned varieties of pears and apples and on stone fruits. Most of these sprays are not so active as fungicides or insecticides when the weather is cold and rainy and hence cannot always be relied upon for effective action in the early spring. They are active in warm weather, however, such as may usually be expected from the time the pear and apple blossoms have fallen. They are safe and effective in warm weather for the control of scab, mildew, leaf spot, and brown rot. It is usually advisable to employ a spreader with them unless a spreader is used in the manufacture. These spray materials are preferred to the old self-boiled lime sulphur and are to be recommended whenever the latter has been advised in the past. The wettable sulphur sprays are used at the rate of 6 pounds to 100 gallons of water.

Among the wettable sulphur sprays are: (1) Those powders or pastes which consist of finely ground sulphur (95 per cent of which should pass a 325-mesh screen), and 5 to 10 per cent of some material, such as the new wetting or degumming agents, skim-milk powder, or blood albumen and clay, such as bentonite. When these wetting or degumming agents are mixed with the sulphur, it is possible to mix the combination with water. (2) Certain commercial products are now available in the market in which the particles of sulphur are very small (50 per cent or more would pass through a 5,000-mesh screen). These include colloidal flotation sulphurs, fused-bentonite sulphurs, and micronized sulphurs.

In preparing these materials for the spray tank, they should first be made into a thin paste and passed through the strainer into the tank. When the wet-

table sulphurs contain 90 to 95 per cent sulphur they should be used at the rate of 6 pounds to 100 gallons.

During very warm weather, the wettable sulphurs may cause foliage or fruit burn on sensitive plants. Hydrated lime used at the rate of 2 pounds to 100 gallons reduces the danger of sulphur burn. For most purposes, however, and under Oregon climatic conditions, the use of lime is not essential. Since lime tends to reduce fungicidal activity, it should be used only when necessary.

Table 1. LIQUID LIME-SULPHUR DILUTION TABLE

For use when stock solution is different from standard strength (32°) when tested by hydrometer.

Strength of stock solution		To make 100 gallons of dilute spray use the number of gallons of concentrated stock lime sulphur indicated in the columns below and add water to make 100 gallons				
Degrees Baumé	Specific gravity	1 Dormant strength for scale clean-up (12-100)	2 Dormant strength for blister mite and twig-miner (8-100)	3 Early spring spray (3½-100)	4 Mid-spring spray (2½-100)	5 Late spring spray (2-100)
		<i>Gal.</i>	<i>Gal.</i>	<i>Gal.</i>	<i>Gal.</i>	<i>Gal.</i>
34°	1.304	11+	7½	3+	2½+	1¾+
32°	1.282	12	8	3½	2¾	2+
30°	1.260	12½+	8½	3¾	2¾+	2+
28°	1.239	14	9½	3¾	2¾+	2½+
26°	1.218	15	10	4	3	2¾
24°	1.198	16½	11	4½	3½+	2¾

Note: Where the + sign is used, employ a little more than the number of gallons indicated. Where the — sign appears, use scant measure.

Dusting. Dusting with finely divided sulphur prepared for orchard use has given good results where properly applied in warm weather for the control of such troubles as brown rot and powdery mildew. The dust should be fine enough so that 95 per cent will pass through a 325-mesh screen. To prevent the particles from lumping, some other material such as magnesium carbonate or bentonite clay should be present in small amount, otherwise the covering power and spread are not satisfactory. In cool, moist, spring weather dusting has not proved as effective as the usual liquid sprays for such a trouble as apple scab. No practicable dusting method for the control of such diseases as apple-tree anthracnose or peach blight has been demonstrated thus far in Oregon.

For spider-mites, sulphur dusts have not proved as effective as the standard liquid sprays. Dormant dusting for scale insects, peach twig-miner, and blister-mite control is yet to be demonstrated as effective. In cool, moist spring and early summer weather nicotine dust has not proved as effective as the liquid spray for aphid control. Later in the season, when summer temperatures are high, nicotine dusting may be used with good results. Effective dusting is impossible unless the air is perfectly quiet as in the early morning.

Bordeaux mixture. Bordeaux mixture of the highest quality can be made by the grower if proper methods are carefully followed. (See Oregon Agricultural Experiment Bulletin 393.) Properly made, it forms a gelatinous suspension that adheres very well and has good spreading properties. No commercial powdered bordeaux has been found equal to it.

The concentration of the bordeaux mixture is designated by the formula. For example, in the formulas 8-8-100, 6-6-100, etc., the first number always refers to the amount of bluestone to use; the second number, the amount of

lime; and the third number, the gallons of water necessary. In home preparation of bordeaux mixture it is important to observe the precautions and follow the directions given in Station Bulletin 393, but the following outline indicates the procedure for making 100 gallons of the 8-8-100 formula:

Bluestone (copper sulphate)	8 pounds
Quick lime	8 pounds
Water	100 gallons

1. Slake the lime carefully and then add to the spray tank containing about 50 gallons of water.
2. Dissolve the bluestone (by method given in Bulletin 393) in a few gallons of water, and with agitator of spray tank going add it slowly to the lime in the tank. The bluestone solution should be added to water as it runs down a trough into the tank.

The bordeaux mixture is then ready for immediate use, but if necessary to delay application, even for a few hours, it should be preserved with sugar used at the rate of one ounce to 100 gallons.

Oil sprays. Great care should be exercised in the selection of the correct oil spray for the specific purpose needed. *There are two contrasting types of oil sprays:* those used for dormant sprays and those classified as summer oil sprays. The oils used in the preparation of the dormant oil sprays are of comparatively low purification and should not be used for summer spraying. On the other hand, the summer oil sprays are of higher purity and more costly.

Summer oil sprays. Where oil emulsions are recommended for use in summer or late spring after the delayed dormant period, it is important that the proper grade and purity of oil be selected for the purpose. The purity of an oil is indicated by the "sulphonation test." The grades are known as "medium," "light medium," and "light" oil. The following indicates the different grades and specifications of summer oil available for spray use:

1. Medium Oil: Viscosity between 65 and 75 seconds Saybolt.
Sulphonation test, not less than 85.
2. Light Medium Oil: Viscosity, 56 to 65 seconds Saybolt.
Sulphonation test, not less than 85.
3. Light Oil: Viscosity, 50 to 55 seconds Saybolt.
Sulphonation test, not less than 85.

Dormant oil sprays. It is not necessary to use oil of high purity for dormant sprays. Accordingly, an oil that has a viscosity between 100 and 120 seconds Saybolt and a sulphonation test between 50 to 70, will be satisfactory for dormant spraying.

Commercial dormant oil emulsions are available in several forms: (1) the old type miscible oil, which is a petroleum oil emulsified by means of soap and cresylic acid; (2) the so-called quick-breaking type oil emulsion, which is primarily a casein-ammonia emulsified oil; (3) various new soluble oils, which may also be classified as emulsible oils that are mixtures of the proper grade of petroleum oil with a soluble emulsifier. Any of these oils, properly used, will be effective as dormant sprays.

To avoid injury, dormant oil sprays should be applied in the spring before the bud scales separate and before the buds show green. Injury may result if dormant oil spray (4 gallons or more to 100 gallons of water) is applied during the critical period (delayed dormant) of bud development. This period occurs during the time the buds first show green and the cluster-bud stage (pre-

pink). Injury is increased by continuous cool, cloudy weather during which time the trees are making little or no growth.

Home-prepared oil emulsions may be made by the orchardist for either dormant or summer application. Directions for preparing these emulsions may be obtained in Station Bulletin 393. More than ordinary care must be taken by the orchardist when preparing these emulsions, in order to obtain a product that will not injure the tree.

Oil-spray dilutions. Commercial oil emulsions vary greatly in the percentage of oil that they contain. The effectiveness of the dilute spray depends primarily upon its actual oil content. Hence all of the recommendations in this bulletin give the percentage of actual oil to be used.

Table 2. OIL-SPRAY DILUTION
Amount of Oil Emulsion to Use in 100 Gallons of Spray

Percentage of oil in concentrated emulsion—→	70%	75%	80%	85%	98%
Recommended proportion of oil in dilute spray	Gal. & Qt.	Gal. & Qt.	Gal. & Qt.	Gal. & Qt.	Gal.
1 per cent	1 & 2	1 & 1 $\frac{1}{2}$	1 & 1	1 & $\frac{3}{4}$	1
2 per cent	2 & 3 $\frac{1}{2}$	2 & 2 $\frac{3}{4}$	2 & 2	2 & 1 $\frac{1}{2}$	2
3 per cent	4 & 1 $\frac{1}{2}$	4 & —	3 & 3	3 & 2	3
4 per cent	5 & 3 $\frac{1}{2}$	5 & 1 $\frac{1}{2}$	5 & —	4 & 2 $\frac{3}{4}$	4
5 per cent	7 & 1 $\frac{1}{2}$	6 & 2 $\frac{3}{4}$	6 & 1	5 & 3 $\frac{1}{2}$	5
6 per cent	8 & 2 $\frac{1}{2}$	8 & —	7 & 2	7 & —	6

Spray residue on cherries. Severe infestation of cherries by the cherry fruit fly may require the application of 1 to 4 sprays to obtain satisfactory control. These sprays consist of lead arsenate, 5 pounds to 100 gallons sweetened with molasses, or lead arsenate 2 $\frac{1}{2}$ pounds to 100 gallons combined with the lime-sulphur leaf-spot spray. Cherries sold for fresh consumption or home canning should be cleaned of any visible residue spots. Cherries for commercial canning are cleaned effectively by the washing procedure usually employed by commercial canneries. More detailed information pertaining to spray residue on cherries may be obtained from Station Bulletin 298.

Tree paint. In case of bark injury from any cause, all loose bark should be trimmed back to healthy tissue. Where branches two inches or more in diameter have been cut or broken off, the stub should be trimmed flush with the surface of the trunk. All exposed wood and bark should be covered with an antiseptic coating. Bordeaux paint has given excellent results if applied after the wound has seasoned for two weeks and is *dry*. This paint is prepared by slowly stirring raw linseed oil into a quantity of commercially prepared bordeaux powder until a very smooth paint is formed. (See Station Bulletin 393.)

Whitewashing trees is widely used as a preventive of sunburn or winter injury of young trees and for the protection of old trees which may have exposed parts.

The following tree whitewash has proved very durable:

Quicklime—4 pounds (Do not substitute)

Skim milk—2 $\frac{1}{2}$ quarts

Water—2 $\frac{1}{2}$ quarts (approximately)

Water-slake the lime to consistency of putty. Avoid burning lime during slaking process. Add the skim milk while the lime-putty is still hot. Stir well. Add water to consistency of house paint. Apply to trunk and scaffold branches of trees with paint brush.

Another approved whitewash for trees is made as follows:

Powder casein	4 ounces
Quicklime	4 pounds
Skim milk	1 quart

Preparation. 1. Soak the casein in about 1 quart of hot water for 2 hours. Slake the quicklime carefully using about 3 quarts of water. Let stand also for 2 hours.

2. Then add the casein to the quicklime suspension and stir thoroughly for about 5 minutes. Then stir in the skim milk, and the whitewash is ready for application.

Shading tree trunks for protection. Boards or barrel staves are sometimes driven into the ground on the south side of the young trees to afford shade in the middle of the day.

Table 3. SPRAY PROGRAM FOR PEACHES

Time of application	Insect or disease	Spray material and strength
1. Dormant spray.	San Jose scale, mildew.	Lime sulphur 12 to 100. If scale is absent dilute 10 to 100. (See mites, p. 2.)
2. Preblossom spray. Blossoms pink just before opening.	Brown-rot blossom blight.	Bordeaux 6-6-100. (p. 10) Cultivate to destroy spore cups arising from mummies on or in ground.
	Bud moths, aphids, twig miner.	Basic lead arsenate 3 pounds to 100 gallons. If aphids present, add 1 pint nicotine sulphate to 100 gallons. These may be added to the bordeaux.
3. First fruit spray. As soon as shucks fall.	Peach blight (fruit spot), mildew, or brown rot.	Use wettable sulphur spray. (See p. 9.) If bad, repeat once or twice at 2- or 3-week intervals.
4. Summer sprays or dusts. Whenever disease appears and near harvest. (See page 6.)	Brown rot, mildew, mites.	Same as No. 3 or use dusting sulphur, applied when the air is still. (See p. 6.)
5. Early fall spray. As soon as each variety is picked.	Peach blight, dieback, and leaf curl.	Bordeaux 8-8-100. (See p. 10.) Cover every bud.
6. Leaf curl spray. Preferably in December, and before winter buds swell.	Peach leaf curl.	Bordeaux mixture 12-12-100. Cover every bud. (See p. 10.)

Table 4. SPRAY PROGRAM FOR PRUNES AND PLUMS

Time of application	Insect or disease	Spray material and strength
1. Dormant spray. As winter buds are ready to open.	San Jose scale, twig miner.	Lime sulphur 12 to 100. If scale is absent dilute 10 to 100. (See spider-mites, p. 2.)
	Lecanium scales and mite eggs. Cultivate to destroy spore cups on ground.	An oil emulsion to give 4 per cent actual oil (See p. 11.)
2. Delayed dormant spray. When first few buds show green tips.	Thrips. If no thrips are present delay spray to green tip and pre-blossom applications.	Lime sulphur 3 gallons to 100 and nicotine sulphate 1 pint to 100 gallons of water.
3. Green - tip spray. Most of buds green at tip.	Thrips.	Lime sulphur 3 gallons to 100 and nicotine sulphate 1 pint to 100 gallons of water.
4. Preblossom spray. Buds white just before opening.	Brown-rot blossom blight.	Bordeaux 6-6-100. (See p. 7 regarding clean-up measures.) Cultivate to destroy spore cups on ground.
	Bud moth. Syneta beetle. Twig miner.	Lead arsenate 4 pounds plus hydrated lime 4 pounds to 100 gallons.
	Aphids.	Nicotine sulphate 1 pint to 100 gallons, plus spreader.
5. First fruit spray. As soon as shucks fall.	Leaf spot and brown rot.	Use wettable sulphur spray. 6 pounds to 100 gallons or sulphur dust. (See p. 9.)
6. Later sprays or dusts. (Western Oregon)	Leaf spot and brown rot.	Apply dust or spray (as in 5) whenever brown rot appears. Applications may be made up to harvest time. (See brown rot pp. 6 and 7.)
6. Later sprays (Eastern Oregon)	Pacific mite. Rust mite.	Lime sulphur 1-2 gallons per 100 according to temperature, when mites appear. (See County Agent.)

Table 5. SPRAY PROGRAM FOR SWEET CHERRIES

Time of application	Insect or disease	Spray material and strength
1. Dormant spray. As winter buds are about ready to open.	San Jose scale. European red mite and brown mite (but not common spider-mite).	Lime sulphur 12 to 100 (See p. 9.) Oil emulsion diluted to give 4 per cent actual oil (See p. 12.)
	Leaf spot.	Plow under old leaves before bloom starts.
2. Preblossom spray. Blossom buds white just before opening.	Brown-rot blossom blight.	Bordeaux 6-6-100 (See page 10). (See p. 7 regarding clean-up measures.) Cultivate to destroy spore cups on ground.
	Syneta beetle. Bud moth.	Lead arsenate 4 pounds plus hydrated lime 2 pounds to 100 gallons of water. Lime not required for lead used in bordeaux. (Dusts, see page 10.)
	Aphis.	Add nicotine sulphate 1 pint and spreader to 100 gallons.
3. Petal-fall spray. When most of petals have fallen.	Brown-rot blossom blight and leaf spot.	Same as in No. 2.
	Syneta beetle.	Same as in No. 2.
4. Shuck-fall spray. As soon as shucks fall from fruit.	Leaf spot and brown rot.	Any wettable type of sulphur spray. (See p. 9.)
5. Later sprays.	Brown rot and leaf spot.	Same as in No. 4. Apply at least every 3 or 4 weeks where these are serious. Give a last application 2 or 3 weeks before picking.
	Cherry fruit maggot.	See p. 4. Use sweetened poison-bait spray on leaves, first, when Royal Anns show slight color; second, ten days later; third, a week after second. Repeat immediately after rain. (Do not combine with other sprays.) Watch for bait notice.

Table 6. SPRAY PROGRAM FOR SOUR CHERRIES

Time of application*	Insect or disease	Spray material and strength
1. Dormant spray. As winter buds are about to open.	San Jose scale, European red mite and brown mite but not common spider-mite.	Lime sulphur 12 to 100 (See p. 10) or an oil emulsion diluted to give 4 per cent actual oil (See p. 12).
	Leaf-spot.	Plow under old leaves before bloom starts.
2. Preblossom spray. Blossom buds white just before opening.	Syneta beetle. Bud moth.	Lead arsenate 4 pounds plus hydrated lime 2 pounds to 100 gallons of water. Lime not required for lead used in bordeaux. (Dusts, see page 10.)
	Aphis.	Add nicotine sulphate 1 pint and spreader to 100 gallons.
3. Petal-fall spray. When most of petals have fallen.	Leaf-spot	2 gallons lime-sulphur (32 Baumé) to 100 gallons of spray.*
	Syneta beetle	Lead arsenate 4 pounds plus hydrated lime 2 pounds added to leaf-spot spray
4. Shuck-fall spray. As soon as shucks fall from fruit.	Leaf-spot	Same as 3
	Syneta beetle	Same as 3
5. Two weeks after shucks fall.	Leaf-spot	Same as 3
	Leaf-spot Fruit fly	Add to the leaf-spot spray 2½ pounds lead arsenate
6. Four weeks after shucks fall.	Leaf-spot Fruit fly	2½ pounds of lead arsenate to 100 gallons of spray. Add wettable sulphur 6 pounds if spray is preceded by heavy rains*

* For more complete information on use of lime-sulphur, wettable sulphur, and combinations of these see Oregon Station Circular of Information 253.