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**COLLEGE OF AGRICULTURE**

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A. W. HELTON

*Department of Plant Pathology*

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Figure 1.—Powdery mildew on Jonathan apple twigs. Center twig is healthy; upper right is most affected.

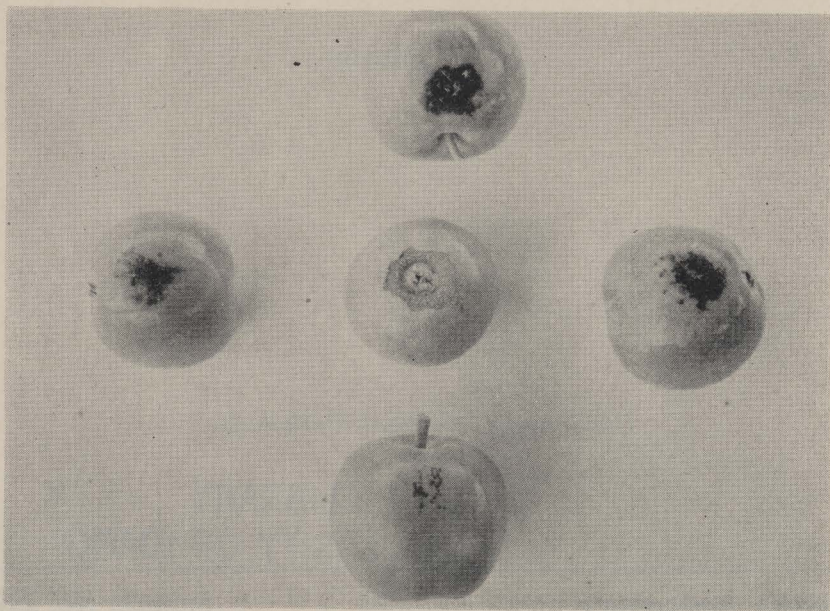


Figure 2.—Sulfur injury to Blackjon apple fruits. A wettable sulfur spray was applied just before cloud cover gave way to bright sunlight.

# Powdery Mildew Control in Idaho Orchards

A. W. HELTON\*

**V**ARIOUS mildews attack and often seriously damage Idaho's tree fruits. Such damage appears to have increased during the last few years.

Powdery mildews ordinarily are considered to be dry weather parasites, but trees that are closely planted and heavily irrigated suffer more than others despite climatic conditions. Nearly all common varieties are damaged by mildew. All varieties are most susceptible when very young or rapidly growing, so that much of the tissue is tender and succulent.

Mildew seems to be most serious on leaves and twigs, but it also damages fruits extensively, some varieties much more than others. For example, Jonathan orchards have suffered heavily, whereas Winesap and Delicious have fared rather well. Pear twigs and foliage frequently are affected later in the season than apple.

## The Pome Fruits

### SYMPTOMS

White to gray powdery growth appears on the surfaces of the leaves. They may then develop various degrees of curling, wrinkling, or folding. The leaves sometimes curl seriously, with those at the twig tips being much reduced in size, distorted, and covered with white mildew. Brittleness and death of the leaves may follow, which indirectly may result in reduced yield and lowered vigor. Similar infections start on young twigs with the powdery covering turning brownish and developing small black specks. Stunting and death of the twigs result.

The fungus causing powdery mildew overwinters on twigs and buds. Such buds produce russeted and distorted fruits, or no fruits at all.

### CONTROL

*Apples.*—Remove mildewed twigs at pruning time. Use different programs for apples and pears and vary these to satisfy the peculiarities of certain varieties.

A satisfactory general spray program for apples consists of 2 to 2½ gallons of liquid lime-sulfur per 100 gallons of spray

\* Assistant Professor of Plant Pathology and Assistant Plant Pathologist, Agricultural Experiment Station.

applied in the pink stage and when the last petals fall (calyx stage). About 9 pounds of dry lime-sulfur may be substituted for the liquid if necessary. Wettable sulfur at the rate of 3 or 4 pounds per 100 gallons should be applied as a first cover spray about two to three weeks after petal fall.

This first cover spray should not be applied in hot weather, nor should it be applied to varieties easily injured by sulfur, such as Delicious and Jonathan. For these varieties not over 2 pounds of sulfur per 100 gallons is recommended when it becomes necessary to spray them. Even then some injury to the fruits may result.

For the general pink and calyx\* sprays, 2 to 3 pounds of polysulfide (sodium) per 100 gallons should give equally satisfactory results. A sulfur dust at the rate of approximately 60 pounds per acre may also be substituted for the pink spray, and for the calyx spray 3 to 4 pounds of wettable sulfur.

Dusting with sulfur may be satisfactory for dwarf trees.

Apple-scab control programs help in the control of powdery mildew of apples.

The use of Elgetol in blossom thinning sprays would retard mildew to some extent but cannot be considered an effective control program in itself. Moreover, blossom thinners are not recommended in Idaho when mildew is serious enough to require control measures.

Karathane is a new product that may prove useful in apple orchards, but more information is needed. It seems to be injurious above 90°F. Some western growers have used Karathane with good results on most apple varieties. An effective schedule seems to be 1 pound (with wetter) in 100 gallons, applied in pink, calyx, cover and later sprays.

In some cases where Karathane has been mixed with organic phosphates such as Malathion, injury has resulted. Injury also is likely if it is applied as a concentrate.

Karathane seems to be superior to sulfur products on Jonathan and Rome Beauty in some areas. In such cases these varieties may be sprayed all summer. Sulfur and lime-sulfur, though less expensive, would soon be unsafe. However, if they are not too injurious under your conditions, use them through the bloom period and follow them with Karathane cover sprays at about 1 pound per 100 gallons if you wish to see what Karathane will do.

*Pears.*—Considerably more variation occurs in pear mildew control. Check the results of your sprays and modify them to suit your conditions.

\* When the last petals fall, leaving the green calyx flower parts.

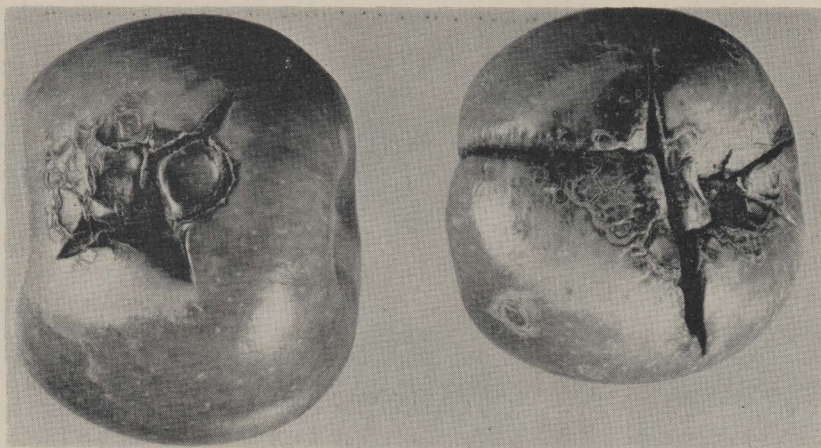


Figure 3.—Lime-sulfur injury to Jonathan apples.

For example, do not make the pink spray for Bartlett's stronger than 2 gallons of liquid lime-sulfur or sodium polysulfide. Use no more than 8 pounds of dry lime-sulfur. For the Anjou pink spray, a better mixture seems to be 1 gallon of liquid lime-sulfur in 100 gallons of water to which 3 to 4 pounds of wettable sulfur is added.

For the calyx spray, 1 gallon of liquid lime-sulfur plus 2 pounds wettable sulfur is good for both varieties. Use 4 pounds of dry lime-sulfur to replace the 1 gallon of lime-sulfur if necessary.

If these pink sprays do not give satisfactory control of pear mildew, use one more gallon of the liquid lime-sulfur the following year. To make this spray safer, add  $1\frac{1}{4}$  pounds of Ferbam to each 100 gallons of spray. Ferbam seems to help reduce sulfur injury and spread of fruit infection as well. For this reason it is sometimes well to put a Ferbam cover spray on orchards seriously affected. Some growers apply a Ferbam cover spray three weeks after petal fall with good results. A concentration of  $1\frac{1}{2}$  pounds per 100 gallons of water is commonly used.

Too little is known about the relative merit of Karathane for pear mildew control. It has caused injury to pears when applied at a strength greater than  $\frac{1}{2}$  pound per 100 gallons.

*Quinces.*—Try the general schedule recommended for apples and modify it as necessary for your area.

### The Stone Fruits

#### SYMPTOMS

The symptoms of powdery mildew are similar on all types of fruits. Leaves show a whitish moldy covering that usually



Figure 4.—Powdery mildew on Bing cherry leaves. Note the great numbers of tiny black specks on the lower leaf surfaces and the rolling of tip leaves.

and misshapen. The mold on cherry fruits is very thin and faint, but serious depressions develop in the surface of the fruits as they ripen. Mildew fungi overwinter in buds and on fallen leaves.

#### CONTROL

*Cherries.*—If you are following a brown-rot control program, it will help to keep the mildew down. Sprinkler irrigation will spread it. Such irrigation near harvest in a mildew-infested orchard is an invitation for fruit losses to occur. Tall weed or other cover crops cause higher orchard humidity, which helps to spread the disease. If they are maintained, they should be kept knocked down or mowed.

Powdery mildew of cherries is caused by a superficial fungus that develops only a thin mold covering on the surface. Because of this, dusts are quite satisfactory in most cases. Apply 60 pounds of dusting sulfur per acre at shuck fall (when the green calyx flower parts have dried and fallen) and repeat three to four weeks later. This will do a reasonable job of controlling the disease. Local conditions will have some effect on timing of the latter application.

changes to brown colors later on. Tiny black specks show up in this discoloration as the summer progresses. Sometimes the mildew is easy to see. Sometimes early infections may show no more than a faint mottling effect in the leaves. In cherries this mottle strongly resembles virus mottling and is most obvious in terminal leaves. Peach leaves may develop slight red spotting and curling before the mold appears.

The twigs of peach trees become curled and stunted as well as the leaves. Cherry twigs usually show only slight effects, mostly a curling of the leaves at twig tips. Leaves of both varieties tend to roll upward when severely infected with mildew.

The fruits of peaches may develop large, moldy patches and become cracked or otherwise stunted



Figure 5.—Powdery mildew on the leaves and twigs of peach. Note moldy patches on both.

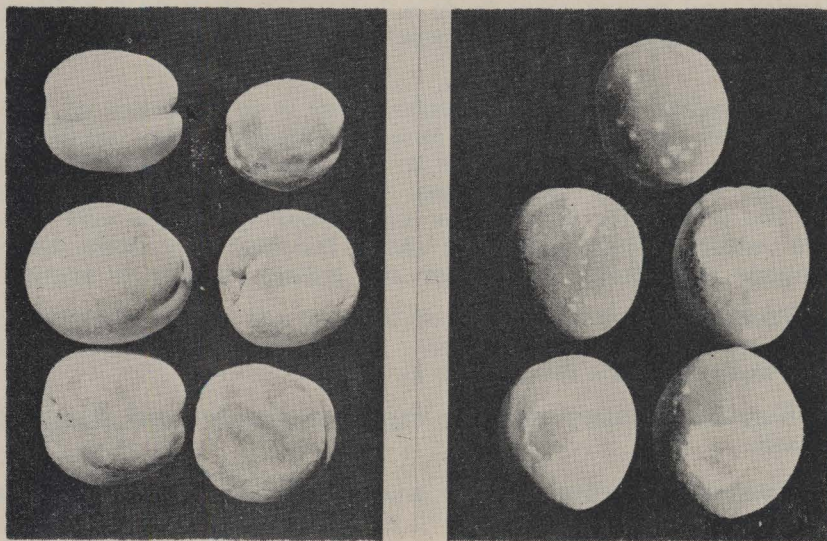


Figure 6.—Powdery mildew of peach (right) and "rusty spot" of peach (left). Rusty spot is a peach fruit spotting disorder similar in appearance to powdery mildew but of unknown cause. Mildew spots are whiter.



Figure 7.—Powdery mildew on peach fruits — an advanced stage showing russeting and cracking. Apples frequently show similar russeting (brownish lines and spots).

An effective spray is 3 pounds of wettable sulfur per 100 gallons. Apply this at the same time you would apply the dusts. Copper A compound sometimes is satisfactory, but it is not as dependable as the sulfur.

If the infestation is serious enough so that a post-harvest treatment seems advisable, apply the wettable sulfur spray again. Ferbam at  $1\frac{1}{2}$  pounds per 100 gallons plus 2 pounds of wettable sulfur also is good.

If you use a concentrate sprayer, 1 pound of sulfur per tree will be enough for large trees. Grade this down proportionately for smaller trees so that trees just coming into bearing will get about  $\frac{1}{4}$  to  $\frac{1}{2}$  pound each.

*Peaches.*—The mildew on peach fruits is heavier than on cherries, and sprays seem to do a better job than dusts. Lime-sulfur is good for controlling peach mildew, but it is sometimes injurious.

One gallon of liquid lime-sulfur plus 3 to 4 pounds of wettable sulfur per 100 gallons of spray is effective when applied at shuck fall. Follow this in one to two weeks with 5 pounds of wettable sulfur per 100 gallons. If past experience indicates that the lime-sulfur is likely to injure your trees, use only wettable sulfur. When applied at shuck fall and two weeks later, 5 pounds of wettable sulfur per 100 gallons usually is enough.

Treat young orchards not of bearing age with the wettable sulfur spray at shuck fall time. After that, treat at two to three week intervals for as long as needed.

Karathane causes shot-hole injury to peaches and shouldn't be used.

*Apricots.*—Apricot mildew should respond to the schedule suggested for cherries.

*Nectarines.*—Use the peach spray program.

*Almonds.*—Almonds should respond to the schedule recommended for peaches.