

THE CONTROL OF WALNUT BLIGHT

in the Pacific Northwest

P. W. Miller

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The so-called "broom" gun, consisting of four or more nozzles mounted abreast on a crossbar which is fastened to an aluminum barrel or lance with the cut-off in the basal casting, is recommended for use in spraying walnut trees. The length of the barrel can be varied according to the height of the trees. The use of this spray gun not only results in better coverage but also reduces the time required to spray the trees thoroughly. Moreover, with this gun, faulty spraying due to inexperienced help is reduced to a minimum, since the operator cannot wrongly adjust the type of spray coming from the nozzle.

Spraying from a platform or tower built on the tank of the sprayer will oftentimes be found more efficient than spraying from the ground; particularly will this be the case in orchards containing trees more than 40 feet high.

The Dusting Machine

A high-velocity dusting machine capable of developing an air velocity of from 150 to 185 miles per hour is more efficient for dusting walnut trees than low-velocity machines. The duster should be equipped with an efficient feed mechanism that will "feed" the dust evenly into the air current. Dual, manually-controlled outlets will expedite the application of the dust.

If the terrain is level, or fairly so, the tractor may be used to furnish power to run the duster. However, if the orchard is located on steep hillsides, an engine-driven type of dusting machine is more efficient.

Tips on Applying Sprays and Dusts

If satisfactory control is to be obtained, the spray or dust materials must evenly coat the nuts during the period for infection. It is essential, therefore, that the materials be thoroughly applied.

To obtain good coverage, the trees should always be sprayed or dusted from two sides. The spray or dust machine should be drawn along one side of the tree row and back along the opposite side. It is impossible to do a good job of spraying or dusting from only one side of the tree.

While it is possible to spray when it is slightly windy, it is impossible to do a good job of dusting when the wind is blowing. The dust, therefore, should be applied in late evening or early morning before the wind starts blowing. Applying the dust in late evening is preferable to dusting in early morning, as the air currents tend to rise in the morning in fair weather while in the evening their direction is reversed; as a consequence, the dust tends to hang in the trees for a long time.

The foliage, preferably, should be moist with dew at the time the dust is applied to permit the copper sulfate and lime to react and form a precipitation membrane that will not wash off.

Walnut Blight Control



Figure 1. A walnut leaf showing bordeaux spray injury.



Figure 2. Appearance under the microscope of the walnut blight organism and its effect upon the tissues of the nut. A. Cross section through small portion of infected tissue showing disintegration of the cellular structure. The bacteria can be seen in the tissues near the arrow. B. Walnut blight bacterium greatly enlarged.

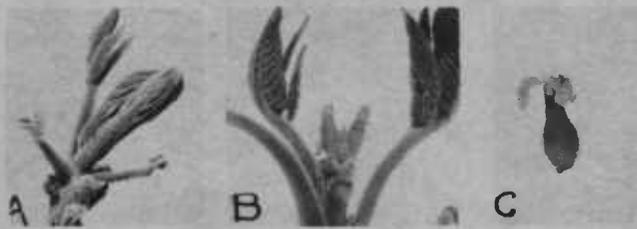


Figure 3. Stages of development at which spray applications have been found effective for control of walnut blight: A. Early prebloom stage, at which time the first application should be made; B. late prebloom stage, at which time the second spray should be applied; C. early postbloom stage, at which time the third application should be made.

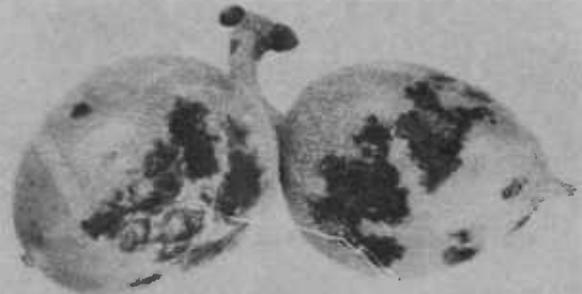


Figure 4. Characteristic appearance of blight on walnuts.

THE CONTROL OF WALNUT BLIGHT IN THE PACIFIC NORTHWEST

By P. W. Miller, U. S. Department of Agriculture
Plant Pathologist at Oregon State College

Walnut blight* is the most widespread and destructive disease of the Persian (English) walnut in the Pacific Northwest. It causes greater annual crop loss than all of the other diseases of walnuts combined.

This disease can be controlled either by a properly followed spray or dust program.

The Spray Program for Grafted Walnuts

Recommended spray materials

Any one of the following spray materials are effective if properly used:

1. Bordeaux 4-2-100. (4 pounds of copper sulphate, 2 pounds of quicklime, or $2\frac{1}{2}$ pounds of hydrated lime, 100 gallons of water.) A summer oil emulsion, at the rate of 1 pint of oil emulsion to every 100 gallons of bordeaux mixture, should be added to pre-bloom applications to reduce the severity of leaf injury in the event that conditions favor its development.
2. Yellow-cuprous oxide (yellow cuprocide), at the rate of 1 pound in 100 gallons of water.
3. Tetra-copper-calcium oxychloride (Copper A Compound), at the rate of 2 pounds in 100 gallons of water. A good compatible spreader-sticker should be used with this material.

Number and timing of spray applications

The number of applications needed to control the disease varies with the season. In years when the rainfall is sparse during the infection period, one properly timed application will control it, but if the rainfall is heavy and prolonged during this period, as many as three properly timed applications are required to hold the disease in check. Since it is impossible to predict the weather during infection period, the wisest course to pursue is to apply the maximum number of applications, which should be made in (A) the early pre-blossom stage, (B) the late pre-blossom stage, and (C) the early post-blossom stage of pistillate flower development. If it is found necessary to eliminate one of these applications, the early post-blossom treatment should be the one omitted, since it is important only in seasons characterized by considerable rainfall after bloom. Omission of one or more applications from the spray program, however, involves risk of unsatisfactory

* Caused by Xanthomonas juglandis (Pierce) Dowson.

control and is not recommended. Each spray application should be completed just as soon as possible--within a three-day period at the most--to forestall the possibility of the intervention of a rainy period, which, if it does occur before the application can be completed, may result in the infection of the unsprayed portion of the crop.

Detailed description of the stages of pistillate flower development at which the applications should be made follows:

A. Early pre-bloom application. This treatment should be made when about 50 per cent of the buds have broken open and the longitudinally-folded leaves are beginning to separate from one another, but before the "blades" of the leaflets unfold. See Figure 3A. The pistillate flowers will not be visible at this stage unless the encircling, longitudinally-folded leaflets are forcibly parted.

B. Late pre-bloom application. This treatment should be made just before the majority of the pistillate flowers come into full blossom. The unexpanded pink or red tip ends (stigmas) of many of the pistillate flowers will be visible at this stage and the flowers will average about 1/8-inch in diameter, or about the size of a grain of wheat. See Figure 3B.

C. Early post-bloom application. This treatment should be made when 50 per cent of the pistillate flowers contain tiny brown spots in the expanded blossom ends (stigmas) but before these turn completely brown. At this time the young nuts will average about 3/16 of an inch in diameter, or about the size of a common vetch seed. See Figure 3C. In an average season there is about a 10-day interval between the late pre-blossom and early post-blossom applications.

It is extremely important that the sprays be applied at the specified stages of flower development, for the success of the spray program depends more on the proper timing of the applications than on any other one factor. Deferring the applications even for a few days after the proper stage of flower or nut development has been attained may mean the difference between success and failure of the spray program.

Sprays should be thoroughly applied as well as correctly timed; if not, poor control will unquestionably follow even though the applications are properly timed. Spraying is not a cure for walnut blight; it serves only as a protection against infection. The degree of protection afforded by spraying is in proportion to the thoroughness of spray coverage. For maximum protection a continuous film of spray should completely cover the developing nuts throughout the infection period.

Variation in the spray program for seedling orchards

Walnut blight in seedling orchards is much more difficult to control than in orchards of a single variety from grafted stock. This is because of the great variation in the blooming periods of individual trees, which makes it extremely difficult to time the applications correctly. To reduce the incidence of infection in seedling orchards to a negligible amount, it is necessary to "spot" spray, that is, to spray the individual trees as they attain the proper stage of development. This means that each tree in the orchard will have to be kept under observation and, when it is in the proper stage, sprayed without delay. Since only a certain proportion of the trees will be found to be in the correct stage of development at any one time, as many as four trips through the orchard may be necessary to complete any one

spray application. The exact number will depend on the extent the trees vary in their blooming periods. In large orchards, admittedly, this procedure is too time-consuming and too costly to follow. The only practical method of spraying large acreages of seedlings is to spray every tree in the orchard when a majority of them are in the proper stage. While doubtless some blight will develop in certain trees that were not in the proper stage when sprayed, a significant reduction in the incidence of infection will follow. The use of three instead of two pre-blossom applications often will enhance the degree of control in seedling orchards, particularly in unusually rainy seasons. The additional pre-blossom treatment should be applied in the middle pre-blossom stage when the immature pistillate flowers are just barely visible.

Spray injury and how to reduce it

Under certain conditions spray burn of immature walnut leaves may follow the application of bordeaux mixture. Young, developing leaflets that contain reddish pigments are particularly subject to injury. The affected areas die and the subsequent growth of the uninjured portions frequently causes the injured leaflets to assume abnormal shapes. See Figure 1. As the leaves approach maturity they become increasingly resistant to injury and at maturity are highly resistant.

The incidence and severity of bordeaux foliage injury can be reduced appreciably by the use of low-lime formula of bordeaux mixture (such as the 4-2-100 formula) to which is added a mineral oil emulsion at the rate of one pint to every 100 gallons of spray. It is not necessary to use an oil emulsion in the post-blossom application as the leaves are quite resistant to spray burn by the time they reach this stage.

The Dust Program

Recommended dust materials

Any one of the following dusts are recommended:

1. A copper-plus-lime-plus-sulphur-plus-oil dust composed of 15 per cent monohydrated copper sulfate, 30 per cent hydrated lime, 10 per cent dusting sulphur, $38\frac{1}{2}$ per cent talc, 2 per cent bentonite, 3 per cent diatomaceous earth, and $1\frac{1}{2}$ per cent light mineral oil.

2. Yellow-cuprous oxide (yellow cuprocide) - sulphur dust composed of 5 per cent yellow cuprous oxide, 15 per cent dusting sulphur, 77 per cent talc, and 3 per cent diatomaceous earth.

In the event that the walnut orchard is interplanted with filberts, the sulphur should be omitted from the foregoing formulae, as it is toxic to filbert foliage under some conditions. The following dust mixtures are recommended in a mixed walnut and filbert orchard.

1. 15 per cent monohydrated copper sulfate, 30 per cent hydrated lime, $48\frac{1}{2}$ percent talc, 2 per cent bentonite, 3 per cent diatomaceous earth, and $1\frac{1}{2}$ per cent light mineral oil.

2. 5 per cent yellow cuprous oxide, 92 per cent talc, and 3 per cent diatomaceous earth.

Number and timing of the dust applications

The number of dust applications needed to control walnut blight will vary from 4 to 6, depending on the amount of rainfall occurring during the critical period for infection. In years when the rainfall is "light" during the infection period, 4 properly timed applications will control blight, while in seasons when the rainfall is "heavy" and protracted during this period, as many as 6 properly spaced applications are required for satisfactory control. Since it is impossible to predict the weather during the infection period, the safest course to pursue is to apply 6 applications every year, which should be made at approximately 7-day intervals, beginning in the early pre-bloom stage.

Spray and Dust Materials and Methods

Bordeaux mixture

Bordeaux mixture consists of a mixture of varying quantities of copper sulfate, hydrated lime and water. The proportion of each ingredient used is indicated in the formula. The quantity of copper sulfate is always given first in the formula, that of lime next, and that of water last. For example, the concentration recommended for the control of walnut blight is 4-2-100. A 4-2-100 bordeaux mixture would contain, therefore, 4 pounds of copper sulfate, 2 pounds of hydrated lime, and 100 gallons of water. If the spray tank holds 400 gallons, 4 times these quantities will be required to make up the quantity according to formula. For further information concerning the preparation of bordeaux mixture, consult Oregon Extension Bulletin 667, Preparation of Bordeaux Mixture.

Dusts

Factory-mixed dusts are more effective as a rule than home-mixed ones, as the factory preparations are mixed more uniformly. If oil is incorporated in the mixture as recommended, the dust must be factory mixed, as special equipment is required for this process.

Some dusting machines have "hoppers" with "self-mixing" devices. These contrivances, while not as efficient as factory mills, will do a fair job of mixing and may be used as an alternative. If they are used, oil should be omitted from the dust mixture.

In making up a copper-plus-lime-plus-sulphur dust, the monohydrated copper sulfate should be placed in the "hopper" first, followed by the requisite amount of lime, and the two should then be thoroughly mixed before adding the sulphur and inert ingredients.

The Spray Machine

Portable power spray machines capable of developing from 500 to 600 pounds pressure per square inch and having a capacity of 20 to 26 gallons per minute are recommended for spraying walnut trees.

Large spray tanks holding 300 to 400 gallons will reduce the number of tank-loads needed to spray the orchard, thereby expediting the application of the spray.