

# BORDEAUX MIXTURE

*Integrated Pest Management for Backyard Orchardists and Home Gardeners*

Bordeaux mixture is an outstanding fungicide and bactericide that has been used for decades to control some diseases of tree fruits and nuts, vine fruits, and ornamentals. The ability of Bordeaux mixture to weather the fall, winter, and spring rains and to adhere to plants makes it an excellent choice for a winter fungicide. If Bordeaux mixture is applied in spring after the tree breaks dormancy, use weaker, more dilute formulations of the mixture to reduce the risk of plant injury. The application of Bordeaux during hot weather may cause yellowing and leaf drop. Leaf burn may occur if rain occurs soon after a Bordeaux application. To reduce the chance of leaf burn, add 1 quart of spray oil for every 100 gallons of spray mixture.

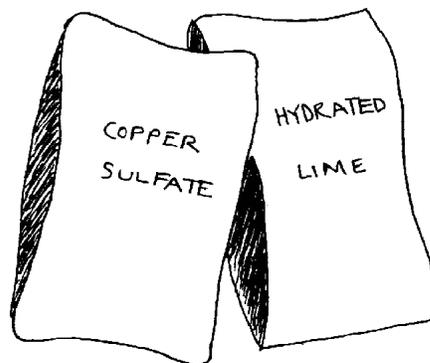
Fixed copper fungicide (tribasic copper sulfate, copper oxychloride sulfate, cupric hydroxide) sprays also control some of the same disease-causing organisms as Bordeaux mixture. While fixed copper sprays are much easier to prepare, they are far less persistent and will not withstand winter rains as well

as Bordeaux mix. They are most effective and are a better choice to use in spring after the trees have broken dormancy and tender leaves are exposed. To be effective for certain pathogens such as the leaf curl fungus, the fixed copper compound must contain at least 50% copper. With all Bordeaux and fixed copper sprays, thorough coverage is essential to give plants the desired protection from disease-causing pathogens. Advantages and disadvantages of both sprays are outlined in Table 1.

Bordeaux is also commercially available in premixed packages; however, these products are not nearly as effective as freshly made Bordeaux.

## BORDEAUX FORMULAS

While there are many Bordeaux formulas for the control of plant diseases, generally the 10-10-100 works well for many disease-causing pathogens. Among its many uses are applications in fall to control the overwintering fire blight inoculum in pears and apples, leaf curl and shot hole pathogens in



peach and nectarine, downy mildew and powdery mildew fungi in grapes, peacock spot pathogen in olives, walnut blight bacteria in walnut, and black spot fungus in roses. Because Bordeaux colors the sprayed plants blue and may discolor house paint, it is not used as often on ornamental plants as it is on trees, vines, or agricultural plants.

The three hyphenated numbers in a Bordeaux formula (e.g., 10-10-100) represent the amount of each material present. The first number refers to the pounds of copper sulfate, the second

**Table 1. Advantages and Disadvantages of Fixed Copper Sprays and Bordeaux Mixture.**

Characteristic	Fixed coppers	Bordeaux mixture
ease of storage	less corrosive, store dry	store only in stock solutions or dry, not mixed
effectiveness	less effective, less persistent	highly effective, deposit highly durable
environmental impact	less active for less time; seldom stains	longer lasting, more active; stains surfaces
phytotoxicity	safe for most plants and tender growth	high pH, salty deposit, more phytotoxic
compatibility	compatible with many pesticides	not compatible with most pesticides
ease of preparation	easily prepared, less safety equipment	takes longer and requires more knowledge to prepare; safety equipment required
corrosiveness	less corrosive spray mixture	corrosive spray mixture

Note: Copper must be kept in dry storage. Effectiveness is a function of coverage, timing, and concentration.

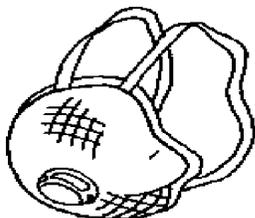


Figure 1. Dust mist respirator.

number refers to the pounds of hydrated lime, and the last number refers to the total gallons of water to be used. Thus, a 10-10-100 Bordeaux means: 10 pounds of copper sulfate, 10 pounds of lime, and 100 gallons of water. A 1 gallon mixture of 10-10-100 Bordeaux contains  $3\frac{1}{3}$  tablespoons of copper sulfate and 10 tablespoons of hydrated lime in 1 gallon of water.

### THE MATERIALS

Copper sulfate and hydrated lime can be purchased at most garden centers.

**Copper Sulfate.** Powdered copper sulfate, often referred to as “bluestone,” is finely ground, dissolves relatively quickly in water, and is a must for the preparation of Bordeaux mixture. Ordinary lump copper sulfate is not satisfactory because it is slow to go into solution. Store copper sulfate in a dry place. If it gets moist, it becomes lumpy and is then difficult to work with.

**Lime.** Either hydrated lime or slaked lime can be used to prepare Bordeaux. The most important point is that fresh lime be used. Don’t use lime from last season.

**Hydrated Lime.** Use only good quality hydrated lime (calcium hydroxide). The hydrated lime should be fresh; i.e., not carbonated by prolonged exposure

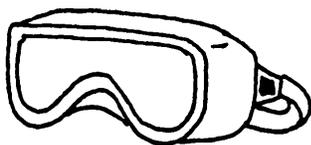


Figure 2. Goggles.

to air. Hydrated lime is stable and usually readily available under several trade names. Because it comes as a dust, protect your eyes, nose, and mouth from any dust powder by using a dust and mist filtering respirator (Fig. 1) when mixing.

**Slaked Lime.** Slaked lime is prepared by adding “quick” (hot, burned, unslaked) lime (calcium oxide [CaO]) to water to produce calcium hydroxide; i.e.,  $\text{CaO} + \text{H}_2\text{O} = \text{Ca}(\text{OH})_2$ . Slaking quick lime in water produces heat sufficient to boil the water, so use caution in regulating the amount of lime added to the water at any one time so that it doesn’t splash. Wear goggles or safety glasses to protect your eyes (Fig. 2). Add enough lime to obtain the consistency of milk. Slaked lime makes an excellent suspension, but requires more time, effort, and containers than the use of prepared hydrated lime.

### MAKING THE BORDEAUX MIXTURE

Bordeaux can be prepared directly in a spray tank equipped with an agitator (Fig. 3) or, for the average gardener who does not have a power sprayer, smaller amounts of it can be prepared for use in a hand sprayer (Fig. 4). In either case, the solution must be used soon after it is prepared. The effectiveness of a Bordeaux compound depends almost entirely on following the correct procedure for mixing.

When applying Bordeaux, be sure to wear protective clothing, including goggles, because the spray deposit is corrosive as well as difficult to wash off.

**Tank Mix with an Agitator.** There are two basic ways to tank mix Bordeaux. If the copper sulfate is already in solution and the lime is in suspension, the two can be added directly to the water in the tank. If this method is followed, it doesn’t matter if the lime suspension is poured into the copper solution or vice versa.

If both materials are still in dry form, follow these steps to make a tank mix:

1. Start water flowing into spray tank.

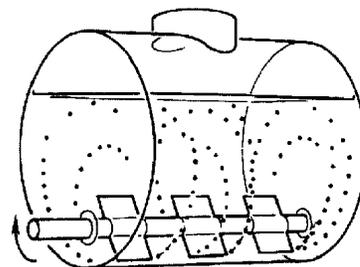


Figure 3. Spray tank with a mechanical agitator.

2. When tank is about one-third full and mechanical agitator is in operation, start washing the copper sulfate into the tank through a screen with water from the supply hose. A wooden paddle is often helpful in working the copper sulfate through the screen. Don’t hurry it through the screen—give the copper sulfate time to get into solution in the tank. By the time the tank is two-thirds full, all of the copper sulfate should be in the tank.
3. In a plastic bucket or other corrosion-resistant container, mix the lime into water, making a suspension. Then slowly pour the lime suspension into the copper sulfate and water mixture. Finish filling the tank to the correct volume of water. (The rinse water from the mixing container can be included.)

The mechanical agitator in the tank should be started before any ingredients are added, continued while the

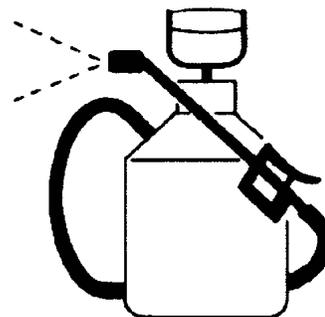


Figure 4. Compressed air hand sprayer.

ingredients are being added, and kept going until the spray is applied. A bypass agitator system is usually not adequate for the preparation of a tank-mix Bordeaux. Bordeaux should be applied the same day it is prepared—the mixture deteriorates upon standing. Also, Bordeaux is highly corrosive to metal tanks and pump parts. After the mixture has been used up, immediately rinse the equipment out at least three times. Add a small amount of vinegar to the rinse water to neutralize any leftover residue.

**Hand Sprayer.** The old-fashioned way of making a Bordeaux mixture is to prepare “stock” solutions of lime and of copper sulfate that are later mixed by pouring them into water in the sprayer. This method also works best for making small quantities of Bordeaux. Using a plastic bucket, dissolve 1 pound of copper sulfate in 1 gallon of water. This solution can be stored indefinitely in a stoppered glass container.

Then mix 1 pound of fresh hydrated lime in 1 gallon of water. This mixture

needs to stand for about 2 hours before use. This mixture may also be stored indefinitely in a stoppered container. Preparing a stock mixture of lime eliminates the need to obtain fresh hydrated lime each time Bordeaux mixture is prepared.

Be sure to clearly label both stock solutions and store them where children cannot get into them; these materials, especially the copper sulfate, are very toxic and corrosive.

To make 2½ gallons of a 10-10-100 Bordeaux mixture, measure 2 gallons of water into a plastic bucket. Because the materials are already in solution or suspension, the order in which they are added to the water does not matter. Shake the stock lime mixture and add 1 quart to the 2 gallons of water. While stirring with a wooden paddle, add 1 quart of the stock copper sulfate solution. Continue stirring for several minutes before pouring into the sprayer. The mixture is now ready to use. Be sure to constantly shake the sprayer while using it to avoid clogging. Read the label directions carefully on the

copper sulfate regarding the proper protective equipment to wear when preparing the stock solutions as well as when spraying.

This formulation of Bordeaux mixture will be adequate for practically all home garden needs. If you wish to maintain Bordeaux mixture on a tree throughout the entire winter rainy period, a slightly stronger mixture (1½ quarts of each stock solution to 2 gallons of water) may be used. In spring when the buds are breaking or on sensitive plants, use a slightly weaker mixture (1 pint of each solution to 2 gallons of water) of Bordeaux, or use a fixed copper spray.

#### COMPILED FROM:

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To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

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#### WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash nor pour pesticides down sink or toilet. Either use the pesticide according to the label or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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