

Bordeaux Mixture Fungicide Preparation

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Bordeaux mixture was first used to control downy mildew in grapes in the 1880s and was the first truly effective chemical mixture developed for plant disease control. Today, it is the most widely used copper fungicide in the world. Although Bordeaux mixture is primarily tapped to control plant diseases caused by fungi, it also effectively manages some bacterial diseases and repels some insect pests. It is sprayed onto plant surfaces to provide protection from pathogens.

Bordeaux mixture is easily prepared from solutions of copper sulfate and calcium hydroxide (lime) to form copper hydroxide. Copper is the only ingredient that is toxic to pathogens while lime's primary role is to protect plants from copper injury. Bordeaux mixture will color plants blue and may discolor house paint as well. The application of the fungicide during hot or cold wet weather can cause yellowing and leaf drop in copper-sensitive plants. Therefore, the formula for preparing Bordeaux mixture is often modified to include a greater concentration of lime to reduce plant injury.

Bordeaux Formulas

Each Bordeaux formula recommended is the result of research on particular diseases affecting specific crops. The formulas are given through a series of three hyphenated numbers. For example, 8-8-100 is the most commonly used recipe for Bordeaux mixture and is prepared by combining 8 pounds of copper sulfate, 8 pounds of hydrated lime, and 100 gallons of water. When spraying plants sensitive to Bordeaux mixture, a much greater concentration of lime may be used, as in

the formula 8-24-100. A small portion of the plant should be treated as a test to determine if injury results. Some of the commonly recommended formulas and their uses are listed in Table 1.

Table 1.

Application for:	Bordeaux Formula
Fire Blight*	2-6-100
Peach Leaf Curl	4-4-100
Needle Cast of Pines	8-8-100
Potato Late Blight	10-10-100
Dormant Sprays	10-10-100
Dead Bud of Cherry	12-12-100

* Fruit russeting may result, and the degree of control is questionable.

Small amounts of Bordeaux mixture can be prepared using the following table:

	100 gallons	1 gallon
Copper Sulfate	1 pound	1/3 tablespoon
Hydrated Lime	1 pound	1 tablespoon

Thus, a one-gallon mixture of 8-8-100 Bordeaux will contain in one gallon of water:

$$8 \times \frac{1}{3} = \frac{8}{3} = 2 \text{ and } \frac{2}{3} \text{ tablespoons copper sulfate}$$

$$8 \times 1 = 8 \text{ tablespoons hydrated lime.}$$

“Ready-mix” preparations of Bordeaux are available on the market but are reported to be less effective than the tank mix or “homemade” Bordeaux mixture. (*When purchasing the ingredients for the preparation of Bordeaux mixture, review the material safety data sheets for each ingredient to determine the necessary precautions. When using any chemical, be certain that the appropriate safety guidelines are followed to prevent injury.*)

Copper Sulfate

Powdered copper sulfate (cupric sulfate, blue copperas, bluestone, or blue vitriol), often referred to as copper sulfate snow, is essential for the preparation of Bordeaux mixture because it is finely ground and dissolves relatively quickly in water. Ordinarily, lump copper sulfate is not satisfactory. Store copper sulfate in a dry place to prevent it from becoming lumpy and wet.

Hydrated Lime

When preparing Bordeaux mixture, use only good quality hydrated lime. Hydrated lime is also called calcium hydroxide, calcium dihydroxide, calcium hydrate, calcite, caustic lime, and slaked lime. Lime should be fresh and not allowed to form calcium carbonate by prolonged exposure to the air. Hydrated lime is usually readily available under several trade names.

If such lime is not available, it may be prepared from “quicklime” (hot, burned, unslaked calcium oxide) by adding water in the reaction: $C_aO + H_2O = C_a(OH)_2$. Be very cautious because slaking quicklime with water produces heat sufficient to boil water. Therefore, care must be taken to regulate the amount of quicklime exposed to the water at any one time to avoid splashing and to use a container able to withstand heat. Slaking quicklime requires more time and effort than the use of already prepared hydrated lime.

Making Bordeaux Mixture

Both copper sulfate and lime should be in the solution before mixing it. If this principle is followed, the lime solution may be poured into the copper solution or vice versa and diluted to the final volume desired.

An alternative method is listed below:

1. Start water flowing into the spray tank.
2. When the tank is about one-third full, constantly stir and wash the copper sulfate powder into the tank through a screen with water from the supply hose. A wooden spoon or paddle is helpful in coaxing the powder through the screen. When the tank is two-thirds full, all the copper sulfate powder should be in the tank. Allow sufficient time for the copper sulfate to go into the solution in the tank.
3. Using the water supply hose, wash the lime through the screen into the solution of copper sulfate in the tank. A wooden spoon or paddle will be useful in working the lime through the screen. Use lots of water.

Be certain that the mixture is always stirred or agitated during preparation and application to prevent the setting of the compounds. Bordeaux mixture should be applied the same day it is prepared because some deterioration occurs upon standing. If the mixture is left overnight before it is used, add an eighth of an ounce of sugar for each pound of copper in the tank. For example, add one ounce of sugar to 100 gallons of 8-8-100 Bordeaux mixture. Do not combine Bordeaux mixture with soaps or organic insecticides that are decomposed by free alkali.

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Issued in furtherance of cooperative extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Jim DeBree, Director, Cooperative Extension Service, University of Wyoming, Laramie, Wyoming 82071.

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