

BORDEAUX MIXTURE - A UNIVERSAL BLEND FOR *Phytophthora* MANAGEMENT IN ARECANUT

R. Thava Prakasa Pandian¹, Shivaji Hausrao Thube¹, M. Chaithra¹, N.R. Nagaraja¹,
Bhavishya¹, Ganesh Khadke² and C. T. Jose¹

Introduction:

Bordeaux mixture is one of the important non-systemic copper fungicides used for the management of many crop diseases. The Bordeaux mixture is a combination of copper sulphate, lime and water. This was accidentally discovered in 1882 and introduced in the year 1885 by P. M. A. Millardet from University of Bordeaux, France for the management of Downy mildew of grapes. Later on it was successfully used for the management of oomycetes pathogens.

Bordeaux mixture accomplishes its effect by means of the copper in the form of cupric ions (Cu^{2+}) of the mixture. These ions affect enzymes in the fungal spores in such a way as to prevent germination. Hence, Bordeaux mixture must be used preventively, before the fungal disease attack. 1% Bordeaux mixture is the commonly recommended fungicide for the management of coconut bud rot, basal stem rot of coconut, arecanut fruit rot (Mahali/ Koleroga), cocoa black pod rot and stem canker diseases.

pH determination of Bordeaux mixture:

The ratio of copper sulphate to lime solution governs the pH of the prepared mixture. The mixture prepared in the above said ratio gives neutral or alkaline mixture. If the quality of the

used materials is inferior, the mixture may become acidic. If the mixture is acidic, it contains free copper which is highly phytotoxic resulting in scorching of the plants. Therefore, it is highly essential to test the presence of free copper in the mixture before applied.

There are several methods to test the neutrality of the mixture, which is indicated below:

1. **Field Test:** Dip a well-polished knife or a sickle in the mixture for few minutes. If reddish deposit appears on the knife/sickle, it indicates the acidic nature of the mixture.
2. **Litmus paper test:** The colour of blue litmus paper must not change when dipped in the mixture.
3. **pH paper test:** If the paper is dipped in the mixture, it should show neutral pH.
4. **Chemical test:** Add a few drops of the mixture into a test tube containing 5 ml of 10% potassium ferrocyanide. If red precipitate appears, it indicates the acidic nature of the mixture.

If the prepared mixture is in the acidic range, it can be brought to neutral or near alkaline condition by adding some more lime solution into the mixture. Practically, field test and pH paper test is used to determine the quality of the Bordeaux mixture.

¹ ICAR-Central Plantation Crops Research Institute, Regional Station, Vittal-574243, Karnataka

² ICAR-Central Plantation Crops Research Institute, Research Centre, Kidu-574230, Karnataka

1% Bordeaux mixture preparation:

To prepare 1% Bordeaux mixture, three main constituents are required i.e. copper sulphate, lime and water. Purity of the ingredients and method of preparation decides the quality and effectiveness of the prepared

solution. Lime is available in the market as two different forms i.e. calcium hydroxide (also called as 'hydrated lime' or 'slaked lime') and calcium oxide (also called as 'quick lime' or 'burnt lime'). Detailed procedure of 1% Bordeaux mixture preparation is summarized below with illustrations (Fig.1).

Fig. 1. Preparation of 1% Bordeaux mixture

- Ingredients of Bordeaux mixture i.e. copper sulphate and lime (quick lime or hydrated lime)

- Dissolve 1 kg copper sulphate crystals in 10 litres of water in a plastic container.
- Dissolve required quantity* of quick lime or hydrated lime in 10 litres of hot water in another plastic container.

* Note: If quick lime is used, ~750g-850g is needed and if hydrated lime is used, ~375g-450g is needed to neutralize the copper sulphate solution.

- Pour both the copper sulphate and hydrated lime solutions simultaneously to 80 litres of water with constant stirring and check for the pH until it becomes neutral.
- The mixture should be tested for its neutrality of the pH (pH of 7.0); because the free radicals of the copper are toxic to the plants.



Checking the pH of the Bordeaux mixture



Checking of Bordeaux mixture with a knife

- To test the neutrality of the pH, either pH paper or a well-polished knife or a sickle can be used for checking.
- Dip pH paper in the solution and if it turns blue it indicates that the mixture is neutral. (or)
- Dip a well-polished knife or sickle into the mixture. If the blade shows a reddish colour, add lime to the mixture till the blade does not show staining on dipping the knife

- As per the weather conditions (rainy/ wet), required quantity of the wetting agents (resin or soap solution) can be added before spraying.
- Mist nozzle should be used for effective spraying.

Preparation of 10% Bordeaux paste

Bordeaux paste consists of the same constituents as that of Bordeaux mixture, but it is in the form of paste as the quantity of water used is too little. For preparation of 10% Bordeaux paste, 100 g copper sulphate and 100 g quick or hydrated lime each are dissolved in 500 ml of water separately and mixed thoroughly until to get a paste.

Uses of Bordeaux mixture/ Bordeaux paste:

- 1% Bordeaux mixture is recommended twice-thrice as a prophylactic spray in the

form of mist spraying.

- First spray during pre- monsoon showers and the second spray after 40-45 days of first spray in the coconut, arecanut and cocoa orchards for the *Phytophthora* disease management. If necessary, a third spraying can be given.

(Please note that first round of spraying should be given on bunches and the rest two rounds should be focused on bunches as well as crown region in case of arecanut to avoid bud/crown rot disease in arecanut)

- Bordeaux paste can be used for swabbing the cut ends of the pruned branches of cocoa plant as well as treatment of canker infected cocoa trees and also in the coconut/arecanut crown portion after removing the crown/bud rot diseased spindle leaves.
- In cocoa, spraying of Bordeaux mixture after pruning will help in reduction of the past season inoculum and protect the preceding season crops from diseases.

Precautions:

- ⇒ The solution should be prepared fresh always in the earthen or wooden or plastic containers.
- ⇒ Avoid using metal containers for preparation, as Bordeaux mixture is corrosive to metal vessels.
- ⇒ The prepared Bordeaux mixture should be sprayed within 4-5 h.
- ⇒ At the time of preparation and spraying proper stirring is required.
- ⇒ Don't add hot water during solution preparation.

- ⇒ Don't mix any fungicides or insecticides along with Bordeaux mixture.

Advantages of Bordeaux mixture:

- Very easy and can be prepared by farmers themselves.
- Can act as fungicide and bactericide.
- The chemicals required for this is copper sulphate and lime which is easily available in the market.
- It is less toxic to humans i.e. safety to handle as compare to other commercial fungicides.
- Possess a natural adhesiveness of tenacity.
- Relatively cheaper.
- Manages relatively a wide range of oomycetes pathogens, especially *Phytophthora* spp.

Reference:

- Keerthana, U., Chaithra, M., Purandhara, C. and Santhoshkumar, P. 2016. *Preparation of Bordeaux mixture*. Extension Folder No.: 246. ICAR-Central Plantation Crops Research Institute, Kasaragod.
