

Bordeaux mixture.

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# Bordeaux Mixture

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Bordeaux mixture, even today, is considered as one of the most efficient fungicides. It is used for the protection of crops against most of the fungal and bacterial diseases of plants all over the world. It is reputed as a good fungicide having no phytotoxicity.

In the preparation of this fungicide, different proportions of the components are used depending upon the nature of the disease. Even on the same crop farmers use formulations with different concentrations based on the age of crops, virulence of pathogens and the environmental conditions. The formulations indicate the quantities of copper sulphate and lime in pounds and water in gallons respectively. The common formulations being used are : 4 : 4 : 100, 6 : 6 : 100, 8 : 8 : 100 and 10 : 10 : 100. When ~~the disease incidence is light~~, used weaker concentrations and higher ones when it is severe. Under all conditions, 1 per cent mixture is found to be the most efficient. In terms of percentage, a 1 per cent mixture contains 10 lb copper sulphate and 10 lb lime in 100 gallons of water, i. e. the mixture contains 10 lb copper sulphate in 1000 lb (100 gallons) of water.

This fungicide is prepared in several ways. It is commonly practised to pour copper sulphate solution into that of lime with constant stirring, and this was considered to be the best method. Recently a new method of its preparation has been suggested by Coombs et al (1961). The fungicide prepared gives a gelatinous precipitate and remains in suspension for a long period. The ability of the precipitate to remain in suspension determines the quality as well as the efficacy of the fungicide.

## Preparation - a new technique.

For preparing the mixture, wooden barrels or earthen pots or plastic containers should be used. A few old 40 gallon oil drums lined with polythene-sheeting may even suffice.

Equal quantities of copper sulphate and lime are generally used in the preparation of Bordeaux mixture. For the reason that only 22.5 per cent of chemically pure hydrated lime is sufficient to precipitate the normal quantity of copper sulphate, the following new ratio has been developed. The lime, as it is liable for deterioration in storage, a 2:1

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ratio of copper sulphate to lime could be safely used. The modified ratio of the ingredients suggests a new method in the preparation of the mixture. About 4 Oz of wetting agent (polythelene oxide type) per 100 gallons of Bordeaux mixture can be added to increase the free flow of the mixture. The following steps may strictly be adhered in its preparation.

About 9 kg. finely powdered or granulated ('instant') copper sulphate may be tied in a hessian cloth and suspended in 25 litres of water, half immersed, from a rod placed wide across the mouth of the vessel. Any of the recommended vessels may be used. The copper sulphate will dissolve overnight and it will be necessary only to stir the solution once or twice in the next morning to mix top with bottom. Copper sulphate will dissolve in water to the extent of 1.35 kg. in 4.5 litres.

The resultant solution is a saturated one and is preserved as a stock solution in suitable containers having proper lids.

Whenever required quantity of Bordeaux mixture of the desired concentration is to be prepared the table given below may be referred, wherein the requirements of the ingredients are given.

For preparing Bordeaux mixture, the required quantity of quick lime is taken in an earthen, wooden or plastic vessel and slaked. This could be done by pouring sufficient water just to cover the lime and allowing it to dissolve in it.

To this then added the measured stock solution of copper sulphate and stirred vigorously. The final volume is made by adding more water.

The resulting mixture gives a deep-blue gelatinous precipitate and remains in suspension for a long time. The suspension is used for spraying.

It is advisable to spray the mixture as early as possible after its preparation. It should never be used, under any circumstances, on the next day of its preparation.

**Table : Volume of stock solution and quantity of lime required for the preparation of different proportions of Bordeaux mixture.**

Bordeaux mixture in litres.	Bordeaux mixture.					
	6: 3: 100		8: 4: 100		10: 5: 100	
	Stock solution in litres	Quick lime in gms	Stock solution in litres	Quick lime in gms	Stock solution in litres	Quick lime in gms.
200	4.00	600	5.33	800	6.66	1000
100	2.00	300	2.65	400	3.33	500
50	1.00	150	1.33	200	1.66	250
25	0.50	75	0.66	100	0.83	125
10	0.20	30	0.27	40	0.33	50

The best mixture when prepared properly will be fine in texture and gelatinous to touch. The sticking and spreading property of the fungicide as well as its efficacy are governed by the slow settling of the suspension. Deep blue colour of the mixture indicates that it is good and prepared properly. A greenish blue colour tells that the copper sulphate proportion is more but a chalky blue colour denotes excess of lime.

### Cares to be taken

Following precautions should be taken to maintain the quality and prevent the deterioration of the fungicide.

1. Use only good quality copper sulphate and lime. Old or exposed lime for a long period does not prepare a good fungicide. When exposed to the atmosphere, especially in humid regions, the quick lime converts slowly into calcium carbonate and thus becomes useless. Hence freshly burned quick lime is recommended. It could be stored in sealed containers without affecting the quality. Either shell lime or stone lime may be used.

2. The containers used in the preparation and transport of the mixture should only be made of either wood or plastic or iron drum lined with polythene sheet.

3. According to the formula mentioned elsewhere the Bordeaux mixture resulting will be alkaline. This test could be done with a litmus paper, which will turn blue when dipped in the mixture. All the copper sulphate added might not be acted if the lime used is

not of good quality and may result an acidic mixture. Acidic mixture will scorch the foliage and it is not advisable to spray.

To test for the excess copper, a few drops of 1 per cent potassium ferrocyanide solution are added to the Bordeaux mixture in a test tube. A reddish brown precipitate, if formed, indicates excess of copper and more lime has to be added for neutralisation. This test also could be done by dipping a clean knife or blade into the mixture for few minutes. A rust like deposit on the blade shows that the mixture is acidic.

4. Bordeaux mixture prepared should be utilised the same day of its preparation as the keeping quality of the mixture is a limiting factor. Utmost care may be taken to prepare only the exact quantity of the fungicide required that could be sprayed the day of schedule itself.

5. The sprayers should not be made of iron or zinc, but should be of either brass or copper.

6. Fine low volume nozzles are preferable to coarse or jet spray as by these large quantities of fungicide are dripped off from the leaves and thus not only proper protection is not possible but quite a large quantity of fungicide is wasted.

Large areas when have to be sprayed and where labour and time are the important limiting factors, delay for the preparation of the mixture is not quite uncommon. Such situations could be avoided by keeping stock solution of copper sulphate and preparing required

quantity of the Bordeaux mixture easily whenever required. The stock solution will not deteriorate if the container is closed properly.

Bordeaux mixture prepared, using the new ratio and technique was not only

found to be more adhesive and persistent but also proved to be free from copper injury. The reduced rate of lime not only helps in bringing down the cost of the product but also makes the preparation less cumbersome by way of easy flow through nozzle.

### References

Coombs, A. V., H. S. Foster and H. L. Haigh. (1961). Trials of copper fungicides adaptation of bordeaux and burgundy mixtures for low volume spraying. Proceedings of the British Insecticide and Fungicide Conference.