

## Improvement in the efficacy of Bordeaux mixture for the control of abnormal leaf fall disease of rubber by addition of zinc sulphate.

Sabu P. Idicula, Thomson T. Edathil, C. Kuruvilla Jacob  
and K. Jayarathnam.  
RRI India

---

### ABSTRACT

Field experiments were conducted to evaluate the efficacy of 0.5% Bordeaux mixture mixed with 0.5% zinc sulphate for the control of abnormal leaf fall disease, caused by *Phytophthora* spp., compared to other conventional copper fungicides such as 1% Bordeaux mixture and oil dispersible copper oxychloride. The experiments were conducted on clones RRIM 600 and RR11 105 in a high rainfall area. The results of the trial indicated that the addition of 0.5% zinc sulphate to 0.5% Bordeaux mixture could give adequate protection to the leaves in both clones against abnormal leaf fall disease.

The percentage leaf retention after the disease season was on a par or better than when the two other copper fungicides were employed. The reduction in the cost of chemicals for the spraying of 0.5% Bordeaux mixture with zinc sulphate compared to 1% Bordeaux mixture is discussed.

---

### Introduction

High volume spraying of 1% Bordeaux mixture is mostly used in the smallholding sector for the control of abnormal leaf fall disease of rubber caused by *Phytophthora* spp. This sector possesses more than 70% of the area under rubber<sup>1</sup>. Bordeaux mixture is used during the immature phase against *Phytophthora* diseases in the estate sector as well. In the light of the large areas which are sprayed with Bordeaux mixture, attempts were made previously to improve high volume spraying, and the efficacy thereof, of Bordeaux mixture used in rubber plantations<sup>2</sup>. Experiments were also conducted with other crops to improve the efficacy of Bordeaux mixture<sup>3</sup>. Some of these experiments yielded better control of the disease with Bordeaux mixture though this has not become particularly popular amongst farmers due to the higher costs of the extra chemicals needed additional to the conventional ones.

The aim of the present study was to control abnormal leaf fall disease of rubber more effectively and economically by the use of a lower percentage Bordeaux mixture (0.5%) fortified with 0.5% zinc sulphate.

### Materials and methods

The experiments were carried out in Palapilly, a high rainfall area in the Trichur district, on clone RRIM 600 which is highly susceptible to *Phytophthora* and clone RR11 105 which is a less susceptible clone but suffers from severe leaf fall in this locality. The trees selected for the experiments were in the fourth (RR11 105) and fifth (RRIM 600) years of tapping and were regularly protected by the spraying of copper fungicides. The experimental area was demarcated into plots of 0.4ha in size to accommodate the treatments, ie 1% Bordeaux mixture, 0.5% Bordeaux mixture and 0.5% zinc sulphate, copper oxychloride (COC) in oil together with an unsprayed control. An unsprayed control was not maintained at the request of the estate management in the case of clone RRIM 600.

Spraying of the Bordeaux mixture was carried out using a high volume power sprayer fitted with a horizontal double piston pump. Spraying of COC was done using a micron sprayer. COC was mixed into an agricultural spray oil in the proportion 1:5 and used at a dosage of 8kg COC powder/ha. Spraying was carried out in May as close to the south-west monsoon as possible. Leaf retention assessment was carried out as per the method suggested by Idicula<sup>4</sup>.

### Results and discussion

The percentage leaf retention in the experimental area is presented in Tables 1 and 2. For clone RR11 105, the 1% Bordeaux mixture and 0.5% Bordeaux mixture with zinc sulphate recorded 70 - 72% leaf retention and both being on a par for the control of abnormal leaf fall disease. Leaf retention in the unsprayed plots was 10 and 27% in the first and second years respectively. COC in oil also registered a lower leaf retention than Bordeaux mixture. Disease incidence was high on this less susceptible clone RR11 105. The high rainfall and presence of a dam in this locality favour a high disease incidence with clone RR11 105.

**Table 1**      *Effect of fungicides on leaf retention with clone RR11 105.*

Fungicide	Leaf retention (%)	
	Year I	Year II
1% Bordeaux mixture	72.0	70.0
0.5% Bordeaux mixture + 0.5% Zinc sulphate	70.0	72.0
COC ( 8kg in 40 litres spray oil)	52.0	-
Unsprayed control	10.0	27.0

**Table 2**      *Effect of fungicide on leaf retention with clone RRIM 600.*

Fungicide	Leaf retention (%)	
	Year I	Year II
1% Bordeaux mixture	63.0	50.0
0.5% Bordeaux mixture + 0.5% Zinc sulphate	62.0	65.0
COC ( 8kg in 40 litres spray oil)	40.0	44.0

In the case of the highly susceptible RRIM 600 clone, 1% Bordeaux mixture and 0.5% Bordeaux mixture with 0.5% zinc sulphate yielded better leaf retention than COC in spray oil at the recommended dosage. Both Bordeaux mixture treatments were on a par in the first year and in the second year 0.5% Bordeaux with 0.5% zinc sulphate registered a maximum of 65% leaf retention. Leaf retention beyond this level is extremely difficult in highly susceptible clones such as RRIM 600 in Palapilly which experiences a high rainfall as well as high humidity due to a huge water reservoir nearby.

The improvement in the efficacy of Bordeaux mixture by the addition of zinc sulphate, as observed in this study, has also been noticed in citrus against *Seppia* sp.<sup>5</sup> and *Phytophthora*

fruit rot<sup>6</sup>. The better efficiency of zinc-copper-lime was attributed to the reduced amount of copper going into solution and thereby prolonging fungicidal activity. Moreover, zinc is also reported to be toxic to *Phytophthora*<sup>7,8</sup>.

The price of copper sulphate has increased considerably in the recent past and consequently spraying cost has also increased. The results of the present study indicate that 0.5% Bordeaux mixture with 0.5% zinc sulphate can replace conventional spraying of 1% Bordeaux mixture thereby saving about half of the quantity of copper sulphate used. The comparative cost of chemicals is presented in Table 3. This indicates that a saving of Rs. 555 per ha could be effected by spraying 0.5% Bordeaux with 0.5% zinc sulphate.

**Table 3**      *Comparative cost of chemicals.*

Chemicals	Cost/ha. in Rs.
1% Bordeaux mixture	1560
0.5% Bordeaux mixture + 0.5% Zinc sulphate	1005
Savings on chemicals	555

**Acknowledgement:** The authors wish to thank the Management of Chemony and Putkukkad Estates, Palapilly, Trichur District for providing their full assistance and co-operation.

#### References

1. Pillai, P.N.R. and Edathil, T.T., Problems of Plant protection in rubber small holdings in India. *III Seminar on progress and development of rubber small-holders, ANRPC, Cochin, 24-30 November 1977, 1977.*
2. Ramakrishnan, T.S. and Pillai, P.N.R., Abnormal leaf fall of rubber (*Hevea brasiliensis*) caused by *Phytophthora palmivora*., *Butl. II, Rubber Board Bulletin*, 5, 2, 76-84, 1961.
3. Gorenz, A.M., Chemical control of Black pod: Fungicides, In *Phytophthora diseases of Cocoa* (Ed. P.H. Gregory), Longman, London, 235-257, 1974.
4. Idicula, S.P., Edathil, T.T. and Jacob, C.K., Spray fluid requirements in high volume spraying of rubber., *J. Plantation Crops*, 16 (supplement), 273-275, 1989.
5. Sree Ramulu, U.S., Chemistry of insecticides and fungicides. Oxford and IBH publishing Co: New Delhi, 342, 1979.
6. Rao, N.N.R., Relative efficacy of a single pre-monsoon spray of some fungicides for the control of brown fruit-rot of citrus., *Indian J. Agricultural Sci.*, 55, 3, 1985.
7. Klotz, L.J., Calavan, E.C., De Wolfe, T.A., Pehrson, J.E., Miller, M.P., Elmer, H.S. and Burns, R.M., New orchard methods of brown-rot control., *Citrograph*, 56, 221-222, 1971.
8. Klotz, L.J., Calavan, E.C., De Wolfe, T.A., Pehrson, J.E., Miller, M.P., Burns, R.M., Clady, C., Lindsay, J. and Cairns, T., Brown-rot control with high and low volume sprays. *Citrograph*, 57, 267-268, 1972.