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EVALUATION OF FUNGICIDES FOR THE CONTROL OF PHYTOPHTHORA SHOOT ROT OF RUBBER

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ABSTRACT

Field experiments were carried out at two locations for three years using systemic and non-systemic fungicides against shoot rot disease caused by *Phytophthora* spp. on young rubber plants. Copper fungicides were superior to other non-systemic fungicides. The systemic fungicide, Fosetyl Al, was not consistent in its efficacy. Addition of Zinc sulphate to Bordeaux mixture yielded better control. Merits of spraying 0.5 per cent Bordeaux mixture with 0.5 per cent zinc sulphate are discussed. The girth increment of rubber in the experimental plots was not significant.

INTRODUCTION

Phytophthora spp. infect the terminal green portions of rubber plants of all age groups causing shoot rot during South-West monsoon period. This disease is more damaging to nursery as well as immature plants. During this phase of growth, due to shoot tip drying and subsequent development of new branches at lower levels, formation of a satisfactory main stem may not be obtained. Copper fungicides were being found effective in checking this disease (Ramakrishnan, 1957). Of the different copper fungicides, spraying of one per cent Bordeaux mixture is being widely accepted among planters. Many chemicals, including some systemics are reported to be specific to *Phytophthora* disease. Therefore, studies were undertaken at Rubber Research Institute of India (RRII) to evolve an effective and economic control of shoot rot disease.

MATERIALS AND METHODS

Field experiments were carried out at wo locations viz. Mundakayam and Thodupuzha for three years (1987-89). In 1987, the treatments were imposed both at Thodupuzha and Mundakayam in clones PB 260 and PB 311 respectively and in 1988 at Mundakayam only in clone PB 311, and in 1989 at Thodupuzha in clone PB-235. In 1987, four replicates with 30 plants in each plot were maintained and in the subsequent years there were only three replicates. These experiments were laid out in randomised block design during the disease season (June-August). In 1987, the chemicals included 1 and 0.5% per cent Bordeaux mixture individually and in combination with 0.5 per cent zinc sulphate, 0.4 per cent Fosetyl Al, 0.5 per cent Copper oxychloride (Coc) WP, 0.2 per cent each of difolatan, mancozeb and thiram. In 1988, two proprietory products viz., 'Cobox L' (Copper sulphate in ammonia liquid) and stabilised Bordeaux both at 1 per cent concentration were included along with the chemicals used in 1987. Based on the results of 1987 and 1988, eight effective fungicides were selected and screened again in 1989. Spraying was done at fortnightly intervals. Unsprayed plots served as control in 1987 and 1988 and in 1989, no such control was maintained as per the request from estate management.

In 1987 and '88 observations were recorded on girth increment and disease intensity, whereas in 1989, only disease intensity was observed. For calculating the percentage disease intensity, the plants were graded, based on symptoms on a 0-4 scale as given below :

0 — No disease
1 — Mild-few black lesions on shoot or on leaves
2 — Moderate - lesions above 3 cm lengn and shoot tip starts rotting
3 — Severe - Shoot rotten from tip upto 10 cm length
4 — Very severe - shoot rotten from tip exceeding 10 cm length

The percentage disease intensity (PDI) was

calculated using the formula

$$PDI = \frac{\text{Sum of numerical ratings} \times 100}{\text{No. of plants observed} \times \text{Maximum disease grade}}$$

RESULTS AND DISCUSSION

The disease intensity recorded at both the locations during 1987-1989 is presented in Table-I. There was practically no disease in Thodupuzha in 1987 season. But at Mundakayam, moderate infection by *Phytophthora* on mature trees and mild shoot rot in young plants were noticed. However, the treatments did not differ significanly.

During 1988 season, at Mundakayam, the unsprayed plots had maximum disease. One per cent Bordeaux mixture with 0.5 per cent zinc sulphate registered the maximum disease control. Mancozeb, thiram and difolatan were inferior to copper fungicides.

The disease incidence was comparatively less during 1989 season. Addition of zinc sulphate to Bordeaux mixture (both concentrations) helped in reducing the disease incidence significantly. Stabilized Bordeaux was on par with Bordeaux and zinc sulphate combinations. Fosetyl Al, a systemic fungicide, was inferior to these fungicides.

Based on three years data, it was observed that copper fungicides are still the best fungicides for containing shoot rot disease. The systemic fungicide, fosetyl Al, was not consistent in its effectiveness. Addition of zinc sulphate to Bordeaux mixture gave better disease control. Rao (1985) reported better control of *Phytophthora* fruit rot of citrus by adding zinc sulphate to 1 per cent Bordeaux mixture. The better efficiency of Bordeaux mixture with zinc sulphate is attributed to the reduction in the amount of copper going into the solution and thereby prolonging the fungicidal activity. Moreover, zinc is also reported to be toxic to *Phytophthora* (Klotz *et al.*, 1972). Bordeaux mixture at 0.5 per cent concentration with 0.5 per cent zinc sulphate was on par with the conventional application of 1 per cent Bordeaux mixture. Considering the cost, this combination is cheaper (Table II). Moreover, this will help in reducing the copper accumulation in soil. Studies on copper residue in rubber soil, conducted in RRII indicate an increase in copper content where spraying of copper fungicides is being carried

Table I. Effect of treatments on shoot rot disease

	Treatments	Percentage disease intensity			Cost/round Rs. per ha
		1987 *	1988	1989	
1.	Unsprayed control	4.27 (24.2)	5.45 (29.4)	—	
2.	Bordeaux mixture 1%	3.22 (10.0)	3.41 (11.7)	1.54 (1.9)	6.4
3.	Bordeaux mixture 0.5%	3.25 (12.5)	3.59 (13.4)	2.15 (4.2)	3.2
4.	Tr. 2 + Zinc Sulphate 0.5%	1.83 (4.2)	2.38 (5.6)	1.15 (0.8)	7.6
5.	Tr. 3 + Zinc Sulphate 0.5%	2.77 (6.7)	2.88 (9.7)	1.20 (1.1)	4.4
6.	COC WP 0.5%	2.24 (7.5)	2.50 (9.2)	1.60 (2.1)	13.2
7.	'Stabilised Bordeaux' 1%	—	2.55 (6.4)	1.47 (1.7)	
8.	'Cobox L' 1%	—	3.24 (11.1)	1.96 (3.3)	
9.	Fosetyl Al 0.4%	1.34 (2.5)	3.45 (11.9)	2.06 (3.8)	
10.	Mancozeb 0.2%	4.50 (20.8)	4.40 (19.2)	—	
11.	Difolatan 0.2%	3.33 (10.8)	5.16 (26.7)	—	
12.	Thiram 0.2%	3.34 (13.3)	4.88 (24.2)		
	CD (P = 0.05)	NS	1.99	0.36	

* Figures in parentheses indicate actual disease intensity and CD for transformed values.

S Cost calculated assuming 20 l would be required to cover one ha.

Table II. Effect of various fungicides on girth increment of rubber

	Treatments	Girth increment (cm)	
		1987 (Thodupuzha) PB-260	1988 (Mundakayam) PB-311
1.	Unsprayed control	2.72	1.77
2.	Bordeaux mixture 1%	3.30	2.23
3.	Bordeaux mixture 0.5%	3.35	2.03
4.	Tr. 2 + Zinc Suphate 0.5%	3.40	2.13
5.	Tr. 3 + Zinc Sulphate 0.5%	3.17	2.00
6.	COC WP 0.5%	3.27	2.10
7.	'Stabilized Bordeaux' 1%	—	2.27
8.	'Cobox L' 1%	—	1.97
9.	Fosetyl Al 0.4%	2.90	1.90
10.	Mancozeb 0.2%	2.90	2.00
11.	Difolatan 0.2%	2.97	2.13
12.	Thiram 0.2%	3.00	1.90
		NS	NS

out yearly against various rubber diseases.

Data presented in Table II indicate that there was no significant influence of the disease on the girth of plants. However, 3-6 months growth of plants was reported to be lost due to shoot rot disease (Pillai *et al.*, 1980).

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