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EFFECT OF ABNORMAL LEAF FALL DISEASE CAUSED BY *PHYTOPHTHORA* SPP. ON THE YIELD OF RUBBER TREE

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Abnormal leaf fall disease was observed to cause 9 to 16 per cent yield loss in susceptible clones of *Hevea brasiliensis*, of 10 to 25 years age, when prophylactic spraying was skipped for one season. The disease adversely affected growth and bark renewal of the trees. The yield in the subsequent year was also affected adversely in unsprayed areas. The disease increased the plugging index and reduced the dry rubber content of the latex. Weed growth was more in the untreated plots.

Key words:–Abnormal leaf fall disease, *Phytophthora* spp., Yield reduction, Yield components, Plugging index, Weed growth, Rubber.

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INTRODUCTION

Abnormal leaf fall caused by *Phytophthora* spp. is the most serious disease of rubber (*Hevea brasiliensis*) in Southern India (Mc Rae, 1918; Petch, 1921). This disease was found to cause yield loss of 38 to 56 per cent when trees of three clones were not sprayed in an experiment conducted three decades ago (Ramakrishnan, 1960). In an attempt to simulate the defoliating effect of this disease by clipping off the leaves from yielding trees to different canopy densities, yield was reduced by 23 and 31 per cent when the defoliation was 50 and 75 per cent respectively (Pillai *et al.*, 1974). Based on the observations of crop loss due to this disease at different regions over several years, the yield loss was predicted to be 30 to 50 per cent (Pillai *et al.*, 1980). Attempts to evaluate the actual crop loss and other physiological effects due to this disease have been meagre for which the present study was aimed at.

MATERIALS AND METHODS

In the absence of standard procedures, the assessment of crop loss due to the disease was made by comparison of paired plots at three locations by the method adopted by Wastie and Mainstone (1969). In Ranni, a 10 year old plantation of RRIM 600, in an area of 0.75 ha with 100 per cent tapping intensity, was given two rounds of motorised ground spraying, the first by mid-April and the second by mid-May using copper oxychloride (56% powder) in diluent oil (1 : 5 ratio) at the rate of 40 l per hectare. In Pathanamthitta, a 15 year old plantation of RRIM 600 in an area of 4.0 ha with 100 per cent tapping intensity was given aerial spraying using copper oxychloride (56%

powder) in diluent oil (1 : 5 ratio) at the rate of 42 l per hectare during May. In Mundakayam a 25 year old plantation of PB 86 with 133 per cent tapping intensity with stimulation was similarly protected by aerial spraying. The number of trees per hectare was 350, 320 and 270 at Ranni, Pathanamthitta and Mundakayam respectively.

In 1984–85 and 1986–87 all the plots were uniformly sprayed while in 1985–86 one set of plots was maintained without spraying. Guard rows were provided between the blocks and appropriate flagging was done to demarcate the plots to avoid drift of fungicide to unsprayed plots. Leaf retention was assessed by the method described by Idicula *et al.* (1986). Annual girth increment was recorded by measuring the girth of 40 trees in each plot at a height of 175 cm from the ground at Pathanamthitta and Mundakayam and that of 10 trees in each plot at Ranni. Thickness of renewed bark was measured using Schlieper's gauge at a height of 1 metre from the ground.

The pre-treatment yield was recorded for one year (1984–85) which was used for computing the predicted yield against which yield loss was calculated. Yield was recorded by cup coagulation at Ranni and by block weighments in the other two locations. The effect of disease on yield components was also studied. Plugging index (PI) was computed as per the method described by Milford *et al.* (1969). Dry rubber content (DRC) was determined by coagulating a known quantity of latex and ascertaining the dry weight and expressed as percentage.

RESULTS AND DISCUSSION

Severe defoliation of trees was observed during 1985–86 in the unsprayed plots in all the locations. Only 6.57, 3.46 and 5.44 per cent leaves were retained on the unsprayed trees at Ranni, Pathanamthitta and Mundakayam respectively. The impact of defoliation on yield was more in 25 year old plantations with clone PB 86 (15.75 per cent loss, i.e., 237 kg/ha) than in 10 year old plantation of clone RRIM 600 (9.27 per cent, i.e., 175 kg/ha) and 15 year old plantation of the same clone (9.57 per cent loss, i.e. 219 kg/ha) in the unsprayed year. The disease had an impact on the growth of the trees as reflected by the reduction in girth increment in the unsprayed plots in younger plantations of RRIM 600. This effect, however, was not evident in the older PB 86 plantation. This indicates that there is no impact on girth increment in older areas. The negative effect of the disease on the rate of thickening of renewed bark also was more pronounced in the younger areas where the parameter is of importance for subsequent tapping while it was negligible in the older areas.

The yield reduction due to the disease was prolonged even in the subsequent year in two of the locations where the yield was recorded during 1986–87 also. The yield in the subsequent year at Ranni could not be recorded due to wind damage resulting in heavy casualty of trees in the experimental plots. As the number of tapping days in the sprayed and unsprayed plots was almost the same, the yield per tapping followed the same trend as the total yield (Table 1).

The computation of PI from both the sprayed and unsprayed blocks during the months in which the disease occurred, revealed that the values were significantly higher in the unsprayed blocks at Pathanamthitta. In Mundakayam, although the PI was higher in unsprayed plots for three months, the difference was not significant, which could be due to the higher intensity of tapping with stimulation (Table 2). Similar effect of stress conditions on plugging index has been well documented (Saraswathy Amma

Table 1. **Impact of fungicidal spray on leaf retention, growth and yield of rubber**

Parameter	Year	Ranni		Pathanamthitta		Mundakayam	
		Sprayed	Un-sprayed	Sprayed	Un-sprayed	Sprayed	Un-sprayed
Per cent leaf retention	1985–86	77.10	6.57	59.93	3.46	75.34	5.44
Girth increment (cm)	1985–86	5.50	4.65	2.27	2.16	1.31	1.90
Bark thickness increment (mm)	1985–86	1.7	1.3	2.3	2.0	0.50	0.60
Yield (kg/ha)	1984–85	1216	1790	2183	2430	1868	1859
	1985–86	1176	1615	2087	2075	1520	1271
	1986–87	—	—	1446	1285	1157	941
Yield per tapping (kg/ha)	1984–85	9.57	9.34	15.56	16.97	20.30	20.20
	1985–86	14.32	12.72 (9.27)	16.86	16.63 (9.57)	16.52	13.81 (15.75)
	1986–87	—	—	11.08	10.32 (14.57)	12.57	10.22 (17.98)

Values in parantheses denote per cent crop loss over projected yield.

Table 2. **Effect of fungicidal spray on yield components of rubber**

Parameter	Month	Pathanamthitta		Mundakayam	
		Sprayed	Unsprayed	Sprayed	Unsprayed
Plugging index	Sep 85	2.92	3.68	3.67	3.08
	Oct 85	3.12	4.12	2.78	3.59
	Nov 85	1.97	2.51	—	—
	Dec 85	2.08	2.79	3.29	3.43
	Jan 86	3.88	3.89	4.67	6.05
t test (P = 0.05)			Significant	Not significant	
Dry rubber content	Sep 85	26.66	23.54	27.66	25.21
	Oct 85	30.04	27.02	28.97	28.05
	Nov 85	31.28	25.46	—	—
	Dec 85	30.21	24.06	30.08	28.12
	Jan 86	33.34	24.08	31.56	28.37
t test (P = 0.05)			Significant	Significant	

and Sethuraj, 1975; Sethuraj, 1977). Sethuraj (1981) also suggested that besides plugging index, the dry rubber content and the length of the tapping cut are important components of yield. The dry rubber content of latex, during September to January, was significantly higher in the sprayed plots. Since the length of the tapping cut remained more or less the same throughout the experimental period, in both the sprayed and the unsprayed plots, the yield obtained is independent of this factor.

Extensive die back of twigs and branches was noticed in the unsprayed plots in all the three locations. The recovery of trees in the unsprayed plot during the subsequent wintering was so poor that the estate managements did not permit continuation of the experiment, originally planned for five years. It was also observed that owing to sparse canopy in the unsprayed plots, weed growth was more in those plots. The additional labour required for sickle weeding at Ranni was 6.5 mandays per hectare over the sprayed plot.

The economics of prophylactic spraying against abnormal leaf fall was estimated by Jayarathnam *et al.* (1987) who reported, on the basis of the cost of spraying and price of rubber, that a loss of 50 kg of rubber per hectare in unsprayed area can justify the additional cost for spraying.

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