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Use of oil dispersible mancozeb as an alternative fungicide for the control of abnormal leaf fall disease of *Hevea*.

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ABSTRACT

Oil dispersible mancozeb was tested in the field at different dosages over two seasons for the control of abnormal leaf fall disease of rubber in clones RRIM 600 and PB 235. The new fungicide formulation gave comparable disease control to that of oil dispersible copper oxychloride at the same active ingredient levels when sprayed from the ground. In aerial spraying, mancozeb gave higher leaf retention compared to copper oxychloride at the same dosage of formulated product.

Introduction

Abnormal leaf fall disease of rubber (*Hevea brasiliensis*) caused by *Phytophthora spp.* has been controlled by prophylactic spraying of copper based fungicides such as Bordeaux mixture and copper oxychloride (COC)[1,2]. An oil dispersible form of COC, in either powder or paste formulation, is being applied with the help of low volume ground sprayers (micron sprayers) or from the air using helicopters[3,4]. The repeated use of COC at the recommended doses was observed to increase the accumulation of copper in the soil[5] and thereby affect soil microflora. Such accumulation of copper also can lead to environmental hazards[6].

Earlier attempts using systemic chemicals like metalaxyl and fosetyl-Al for the control of abnormal leaf fall disease proved ineffective. The present study was aimed at evaluating an oil dispersible formulation of mancozeb for the control of this disease.

Materials and methods

Field experiments to evaluate oil dispersible mancozeb formulations were carried out over two disease seasons at two locations. In the first season, powder formulation of mancozeb (34.5% ai) was sprayed using a low volume micron sprayer. At one location, the fungicide was sprayed onto clone RRIM 600 at rates of 1.5, 2.0 and 3.0 kg/ha in 0.4ha plots along with COC sprayed at the recommended dose (8 kg/ha) with unsprayed plots as controls. Leaf retention was evaluated visually after the disease season.

In the second location, the trial plots were in a randomised block design with clone PB 235 using three levels (viz. 2.24, 3.36 and 4.50 kg ai/ha) of either mancozeb (34.5% ai) or COC (56% ai) as treatments with an unsprayed control. The plot size was 0.25ha (100 trees). Only one round of spraying using the micron-sprayer was carried out. A spray volume of 36 l/ha was used. Leaf retention assessment was carried out according to the leaf counting method described by Idicula *et al*[7].

During the second season, three field trials were laid out, two with clone RRIM 600 and one with clone PB 235. For the former clone at the first location, micron spraying of different formulations of mancozeb was carried out at the rates of 5 kg/ha in 0.4ha plots. The formulations tried were mancozeb 70% powder, mancozeb 50% + COC 15% powder and mancozeb 26% + COC 10% liquid. COC 56% sprayed at the rate of 8 kg/ha with unsprayed

plots as the controls. Leaf retention was assayed by the leaf counting technique.

At the second location, aerial spraying of two formulations of mancozeb was done at the rate of 5 kg/ha in 4ha plots. The formulations used were mancozeb 70% powder and mancozeb 50% + COC 15% powder. COC 56% sprayed at the rate of 5 kg/ha formed the control. Leaf retention was assessed by the leaf counting method.

In the case of clone PB 235, a replicated field trial was laid out in a randomized block design with a 0.25ha plot size. Three formulations of mancozeb were sprayed, viz mancozeb 70% powder, mancozeb 50% + COC 15% powder and mancozeb 26% + COC 10% liquid. COC sprayed at different dosages (viz 2.24, 3.36 and 4.50 kg ai/ha) and unsprayed plots were maintained as controls. Leaf retention was assessed by the leaf counting technique. The data collected from the replicated trials were analysed statistically.

Results and discussion

The result of the visual assessment of leaf retention in mancozeb sprayed plots with clone RRIM 600 for the first season is presented in Table 1. The results indicated that mancozeb afforded good protection at the different levels used when compared to unsprayed plots. However, COC at the recommended dose (8kg/ha) was slightly superior to mancozeb. There was no appreciable difference in leaf retention between the different mancozeb dosages used.

The results of the replicated trial for the first season are presented in Table 2. There was no appreciable difference in leaf retention among the treatments. Leaf retention in plots sprayed with mancozeb at different levels of active ingredients was found to be equivalent to that in COC sprayed plots. The unsprayed control plots had much lower leaf retention

Table 1 *Effect of micron spraying of mancozeb 34.5% with clone RRIM 600*

Treatments	Dose (kg/ha)	Leaf retention (%)
Mancozeb	1.5	25
Mancozeb	2.0	30
Mancozeb	3.0	35
Copper oxychloride (56%)	8.0	40
Unsprayed	-	10

Table 2 *Comparative efficacy of micron spraying with mancozeb and copper oxychloride with clone PB 235*

Treatments	ai/ha (kg)	Formulation/ha (kg)	Leaf retention (%)
Mancozeb 34.5% powder	2.24	6.50	42.39
Mancozeb 34.5% powder	3.36	9.74	42.68
Mancozeb 34.5% powder	4.50	13.04	42.14
Copper oxychloride 56%	2.24	4.00	46.04
Copper oxychloride 56%	3.36	6.00	42.91
Copper oxychloride 56%	4.50	8.00	49.15
Control	-	-	18.43
CD			NS

During the second season, micron spraying of clone RRIM 600 showed that both of the mancozeb powder formulations used were superior to the liquid formulation (Table 3). COC at a dose of 8 kg/ha afforded better protection.

The mancozeb powder formulation (70% ai) gave significantly higher leaf retention (92.72%) when sprayed aerially (Table 4) compared to COC (19.51%). The formulation of mancozeb 50% + COC 15% also afforded good protection.

Table 3 *Effect of micron spraying with different formulations of mancozeb with clone RRIM 600*

Treatments	Formulation	Dose (kg/ha)	Leaf retention (%)
Mancozeb (70%)	Powder	5.00	45.39
Mancozeb (50%) + COC (15%)	powder	5.00	43.33
Mancozeb (26%) + COC (10%)	Liquid	5.00	27.05
COC (56%)	Powder	8.00	62.57
Unsprayed	-	-	11.26

Table 4 *Effect of aerial spraying of mancozeb with clone RRIM 600*

Treatments	Dose (kg/ha)	Leaf retention (%)
Mancozeb (70%)	5	92.72
Mancozeb (50%) + COC (15%)	5	78.50
COC (56%)	5	19.51

Table 5 *Comparative efficacy of mancozeb formulations using micron spraying with clone PB 235*

Treatments	Formulation	ai (kg/ha)	Formulation (kg/ha)	Leaf retention (%)
Unsprayed	-	-	-	20.72 (26.89)
Mancozeb (70%)	Powder	2.24	3.20	36.03 (36.76)
Mancozeb (70%)	Powder	3.36	5.00	57.87 (50.03)
Mancozeb (50%) + COC (15%)	Powder	2.24	3.45	44.29 (41.72)
Mancozeb (50%) + COC (15%)	Powder	3.36	5.16	38.96 (38.56)
Mancozeb (26%) + COC (10%)	Liquid	3.36	9.33	42.04 (40.30)
Mancozeb (26%) + COC (10%)	Liquid	4.65	12.92	47.72 (43.66)
COC (56%)	Powder	2.24	4.00	38.82 (38.52)
COC (56%)	Powder	3.36	6.00	46.10 (42.75)
COC (56%)	Powder	4.50	8.00	55.59 (48.20)
CD (P = 0.05)				7.77

The efficacy of different formulations of mancozeb compared in the replicated trial during the second season indicated that the mancozeb 70% powder formulation at 3.36kg ai/ha gave the highest leaf retention (58.87%), comparable to that obtained by using 3.36 and 4.5kg ai/ha of COC (Table 5). The liquid formulation showed comparable effectiveness only when the mancozeb content was maintained at 3.36kg ai/ha rather than the combined active chemicals, COC and mancozeb, at that level.

An excessive copper supply to *Hevea* seedlings is reported to affect the proportion of rubber content in the stem[8]. Accumulation of copper in soils can lead to such problems. Mancozeb may be a useful alternative for abnormal leaf fall disease control. This fungicide has been suggested as one of the effective fungicides for the control of South American Leaf Blight of *Hevea*[9]. Water based formulations of mancozeb have been found to be effective for the control of black stripe disease caused by *Phytophthora spp.*[10] and for birds eye spot caused by *Drechslera heveae*[11] in rubber. However, oil dispersible formulations of mancozeb have not yet been tried in rubber.

The results of the present investigation indicate that an oil dispersible formulation of mancozeb is as effective as a formulation of copper oxychloride when low volume ground spraying is used. The high degree of protection observed in aerial application of mancozeb needs further confirmation based on multi-locational trials.

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