EVALUATION OF FOUR HERBICIDES FOR CONTROL OF BROAD LEAF WEEDS IN RUBBER

Conventional manual weeding accounts for about 34 per cent of the total cost of cultivation of rubber during the immature phase, which is generally seven years, and is the costliest single input. A herbicide based integrated weed management system has been reported to reduce this cost considerably (Mani et al, 1987). Since the weed flora composition in rubber plantations varies widely, a combination of herbicides is necessary for effective weed control (Anon. 1984). Currently the recommended herbicides used in rubber cultivation are Glyphosate, Paraquat, 2, 4-D Sodium Salt and Dalapon in various combinations. There is, however, a need to find out an alternative to 2, 4-D Sodium Salt for enhanced control of broad leaf weeds, especially hardy perennials.

A field experiment to evaluate four herbicides for control of broad leaf weeds in rubber was laid out at the Central Experiment Station of the Rubber Research Institute of India at Chethackal in November, 1985, to identify an alternative to 2, 4–D Sodium Salt. Spraying was confined to planting strips with a plot size of 25 m^2. The area selected was infested by both broad and narrow leaf weeds. The predominant weed flora in the experimental area were *Lantana camara* L, *Sida rhombifolia* L, *Mimosa pudica* L, *Hemidesumus indicus* L, *Chromoleana oderata* L, *Axonopus compressus* (SW) Beauv, *Digitaria adscendens* (H. B. K.) Henr, *Borreria ocymoides* DC and *Paspalum conjugatum* Berg.

There was some variation in the broad leaf weed flora composition, with perennials like *Lantana camara, Sida rhombifolia, Hemidesmus indicus, Mimosa pudica* etc. becoming predominant in some plots. The average height of weeds at the time of spraying was 15 to 30 cm. The four herbicides evaluated were Dicamba at 0.96, 1.44 and 1.92 kg ai/ha, 2, 4–D Sodium salt at 0.80, 1.60 and 2.40 kg ai/ha, 2, 4-D ethyl ester at 1.02, 1.36 and 1.70 kg ai/ha and 2, 4–D dimethylamine at 1.08, 1.44 and 1.80 kg ai/ha. The trial consisted of 13 treatments, including a no herbicide control, in a randomised block design with three replications. The herbicides were sprayed at a constant spray volume of 400 l ha^{-1}. Spraying was done with a lever operated knap sack sprayer at a constant pressure of 1 kg cm^{-2} with a WFN–40 floodjet nozzle. The spraying was done at an average height of 30 cm from the weed canopy. Weed canopy coverage was visually rated and expressed in percentage (0 = total absence of weeds and 100 = complete weed coverage). Observations on percentage overall, broad leaf and narrow leaf weed coverage at 30, 60 and 90 days after spraying (DAS) were recorded. Statistical analysis of pre and post-treatment observations was done after angular transformation of the data. The data on pre-treatment weed coverage did not show any significant differences.

At 30 DAS all herbicide treatments gave a significantly superior broad leaf weed control as compared with the control, except 2, 4–D Sodium salt at 2.40 kg ai/ha (Table 1). The relatively poor performance of 2, 4–D Sodium salt at the highest level (2.40 kg ai/ha) on broad leaf weed control could be due to the relative abundance of perennials (*L. camara, C. oderata, S. rhombi-*

Table 1. **Mean percentage weed coverage at 30, 60 and 90 days after spraying (DAS)**

Treatments	At 30 DAS			At 60 DAS			At 90 DAS		
	Overall	Broad leaf	Narrow leaf	Overall	Broad leaf	Narrow leaf	Overall	Broad leaf	Narrow leaf
Dicamba 0.96 Kg ai/ha	39.06 (40.00)	16.21 (8.00)	33.91 (32.00)	47.22 (53.33)	8.61 (3.33)	45.19 (50.00)	37.60 (38.33)	7.72 (1.92)	36.43 (36.42)
Dicamba 1.44 Kg ai/ha	32.22 (30.00)	17.05 (8.83)	23.76 (21.17)	30.29 (26.67)	13.78 (6.00)	26.18 (20.67)	28.24 (23.33)	6.10 (1.17)	27.46 (22.17)
Dicamba 1.92 Kg ai/ha	35.22 (33.33)	16.42 (8.33)	29.75 (25.00)	42.14 (43.33)	11.32 (4.00)	38.37 (39.33)	38.93 (40.00)	12.64 (4.92)	35.62 (35.08)
2, 4–D Na Salt 0.8 Kg ai/ha	34.92 (33.33)	19.60 (13.67)	26.31 (19.67)	39.96 (41.67)	13.73 (5.67)	35.48 (36.00)	31.15 (28.33)	8.83 (3.08)	29.28 (25.25)
2, 4–D Na Salt 1.6 Kg ai/ha	43.08 (44.67)	24.07 (19.33)	31.31 (27.33)	48.27 (55.00)	12.92 (5.00)	45.17 (50.00)	50.97 (60.00)	16.93 (9.50)	45.29 (50.50)
2, 4–D Na Salt 2.4 Kg ai/ha	50.85 (60.00)	30.78 (27.00)	34.52 (33.00)	29.53 (25.00)	18.05 (10.00)	21.52 (15.00)	43.08 (46.67)	18.39 (10.17)	36.79 (36.50)
2, 4–D Ethyl ester 1.0 Kg ai/ha	43.45 (48.33)	21.15 (13.50)	34.72 (34.83)	55.69 (65.00)	16.21 (8.33)	48.16 (56.67)	57.90 (70.00)	22.19 (14.50)	48.52 (56.50)
2, 4–D Ethyl ester 1.36 Kg ai/ha	36.93 (36.67)	15.78 (8.33)	31.94 (28.33)	44.18 (48.33)	24.81 (18.33)	31.07 (30.00)	50.88 (60.00)	18.17 (10.83)	44.54 (49.17)
2, 4–D Ethyl ester 1.70 Kg ai/ha	54.78 (66.67)	27.96 (22.00)	41.91 (44.67)	50.00 (58.33)	14.76 (6.67)	45.86 (51.67)	50.00 (58.33)	19.60 (13.67)	41.92 (44.67)
2, 4–D dimethyl amine 1.08 Kg ai/ha	54.99 (66.67)	22.98 (55.33)	45.79 (51.33)	38.85 (40.00)	12.92 (5.00)	35.59 (35.00)	50.00 (58.33)	14.08 (6.42)	45.99 (51.92)
2, 4–D dimethyl amine 1.44 Kg ai/ha	39.23 (40.00)	15.55 (8.00)	34.36 (32.00)	48.93 (56.67)	12.92 (5.00)	45.90 (61.67)	57.99 (71.67)	17.01 (9.25)	52.33 (62.42)
2, 4–D dimethyl amine 1.8 Kg ai/ha	50.85 (60.00)	19.65 (11.67)	44.00 (48.33)	58.93 (73.33)	12.92 (5.00)	55.77 (68.33)	58.93 (73.33)	21.73 (14.42)	50.22 (58.92)
No herbicide Control	63.55 (78.33)	42.30 (45.33)	34.31 (33.00)	63.55 (78.33)	35.67 (35.00)	40.77 (43.33)	60.26 (75.00)	32.74 (28.75)	38.28 (38.58)
S. E.	4.88	4.16	5.87	7.99	2.69	8.64	6.26	3.84	6.02
C. D. (P=0.05)	14.20	12.12	..	..	7.86	..	18.23	11.19	..

Note: 1. S. E. and C. D. are for transformed data viz; angles

2. The figures within parenthesis indicate actual percentage of weed coverage

folia, M. pudica etc.) in the broad leaf weed spectra observed in the respective plots. The overall weed control at 30 DAS was significantly better than the control with all the three levels of Dicamba and 2, 4–D Sodium salt, as well as 2,4–D dimethylamine at 1.44 kg ai/ha. The other herbicide treatments did not show a good overall weed control because, of the predominance of narrow leaf weeds (Table 1).

At 60 DAS all the herbicide treatments gave significantly better broad leaf weed control. The performance of the highest dose of 2, 4–D Sodium salt (2.40 kg ai/ha) in controlling broad leaf weeds was at par with other herbicide treatments. Obviously the herbicidal action of 2, 4–D Sodium salt on perennials like *L. camara, C. oderata, S. rhombifolia*, etc. is a slow process. There was a marked floristic shift to the narrow leaf spectra by 60 DAS (Table 1). This explains why none of the herbicide treatments showed any significant overall weed control at 60 DAS.

At 90 DAS except the lowest dose of 2, 4–D ethyl ester (1.02 kg ai/ha) and 2, 4-D dimethylamine (1.80 kg ai/ha), all herbicide treatments gave significantly better control of broad leaf weeds as compared to the no herbicide control. It was observed that in the plots sprayed with the lowest dose of 2, 4–D ethylester (1.02 kg ai/ha) there was no complete eradication of broad leaf weeds, especially perennials, and there was considerable regrowth by 90 DAS. All levels of Dicamba and 2, 4–D Sodium salt at 0.80 kg ai/ha gave similar overall weed control and were significantly better than the control while all the other herbicide treatments did not show any significantly better overall weed control.

Dicamba at all levels showed consistantly excellent broad leaf weed control. It was also very effective for controlling certain perennials and problem weeds. This is in conformity with the findings of Aamisepp and Granstrom (1964). Harranger et al (1965) and Orozco(1972). The 2,4-D ester and amine formulations also gave good weed control which is in agreement with the earlier reports (Anon, 1971 ; Orozco, 1972). However, the weed control with the ester and amine formulations of 2, 4–D were not consistant till 90 DAS. Moreover, 2, 4–D ester formulation, being volatile, may enhance drift hazard to rubber. 2, 4–D Sodium salt gave a very good control of annual broad leaf weeds justifying its use in the current integrated weed management system in rubber. However, the effect of 2, 4–D Sodium salt on broad leaf perennials was rather slow and has to be supplemented with suitable herbicides where perennials are predominant in the broad leaf weed spectra.

There seems to be good scope for using Dicamba in rubber plantations for controlling certain problem weeds. In the light of the observation of Addnik (1973), who reported that a mixture of 2, 4–D and Dicamba proved generally synergistic, it is necessary that combination of Dicamba and 2, 4–D be experimented with in future trials.

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