INTEGRATED WEED MANAGEMENT IN THE PLANTING STRIPS OF RUBBER

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The efficacy of different weed management methods for immature rubber was evaluated in a field experiment. The treatments included manual (scraping and slashing) and chemical (glyphosate and paraquat + 2,4-D) methods as well as their combinations to control weeds along the planting strips and plant basins. Application of glyphosate in the entire planting strip was the most cost effective method. The integrated approach of spraying glyphosate in the plant basin and slash weeding the remaining area was also found to be cost effective and eco-friendly.

Key words: Herbicide, Rubber, Weed management.

INTRODUCTION

Weed management is an important and expensive agronomic input especially during the immature phase of rubber cultivation. Weed control alone accounts for about 28 per cent of the total cost of cultivation (Mani and Pothen, 1987). Manual and chemical weeding are often used in rubber plantations for controlling weeds. Scraping and slashing are commonly resorted to in manual weeding. Scraping exposes the top soil. Exposed tropical soils degrade rapidly, their structure deteriorates and nutrients are lost by leaching and run off (Chung, 1997). Slashing results in rapid re-growth of the weeds necessitating more frequent weeding rounds. The swelling cost and the limited supply of labour are the other associated problems. Chemical weed control was reported to be more cost effective than manual weeding (Esekhade *et al.*, 1996). However, in view of the long term sustainable benefits of eco-friendly measures, an attempt was made to develop an integrated method which involves manual and chemical control measures for the management of weeds in the planting strips of rubber.

EXPERIMENTAL

A field experiment was conducted at Shaliacary Estate, Punalur, from 1995 to 1999 to evaluate the efficacy of different weed management methods. The treatments included were scraping the entire platform (T1) as control, slashing the weeds in the entire planting strip (T2), spraying paraquat (Gramoxone) 2.25 L/ha + 2,4-D (Fernoxone) 1.25 kg/ha in the entire strip (T3), spraying glyphosate (Round up) 2 L/ha in the entire strip (T4), scraping the plant basin and slashing the weeds in remaining area in the strip (T5), spraying paraquat (Gramoxone) 2.25 L/ha + 2,4-D (Fermoxone) 1.25 kg/ha in the plant basin and slashing weeds in the remaining area (T6) and applying glyphosate (Round up)

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2 L/ha in the plant basin and slashing the weeds in the remaining area (T7). Herbicides were applied using a knapsack sprayer fitted with flood-jet (WFN-40) nozzle. A leguminous cover crop, *Mucuna bracteata* was established and maintained in the interrow spaces for the control of weeds in all the plots. The experiment was laid out in randomized block design with seven treatments replicated four times. Plot size was 2278 m^2 with 10 plants at a spacing of 6.70 x 3.35 m.

The common weed species observed in the experimental area were *Borreria* sp., *Cynodon dactylon, Ageratum conyzoides, Mimosa invisa, Axonopus compressus* and *Digitaria* sp. The treatments were imposed initially during the month of September 1995. The weed regeneration in each plot was assessed based on visual evaluation of weed coverage and ratings were expressed on a scale of 0 (absence) to 100 (complete coverage) of weeds at monthly intervals. Treatments were repeated when the weed coverage was more than 50 per cent in at least three replications of a particular treatment (Philip *et al.*, 1998). To assess the weed growth, representative samples were collected 45 days after the imposition of treatments from each plot using quadrates of size 0.5 x 0.5 m, dried and expressed as dry weight per m^2. The girth of rubber was recorded annually. The data were subjected to analysis of variance.

RESULTS AND DISCUSSION

Effect on weed control

The extent of weed control varied among different weed management treatments from 1997 onwards (Table 1). During this time, the weed control was most effective in scraped plots closely followed by glyphosate and paraquat + 2,4-D sprayed plots. The integrated approach of spraying glyphosate in the plant basin and slashing of weeds in the remaining area recorded a comparable percentage of weed infestation. Slash weeded plots were significantly inferior to all other treatments, as expected, because of the rapid regeneration of weeds from remaining living portion.

In 1998 also better weed control was obtained in scraped plots and the treatment was superior compared to other treatments (Table 1). The percentage weed infestation in the herbicide treated plots (T3 and T4) and the treatments with either herbicide spray or scraping the plant basin and slashing weeds in the remaining area (T5, T6 and T7) was comparable and well within the acceptable limit (<50%). The weed growth was found to be maximum in slashed plots and the weed infestation percentage could not be kept below fifty in spite of the frequent repeated operations. The percentage weed infestation remained minimum in the scraped plots in 1999 also. The weed control observed in glyphosate and paraquat + 2,4-D sprayed plots were comparable to that of scraping and were significantly superior to all others.

The effect of combinations of either scraping or herbicide spray in the plant basin and slashing the weeds in the interplant area were comparable. All these treatments recorded satisfactory control of weeds with comparatively fewer rounds.

Effect on weed biomass

The effect of different weed management operations on mean weed biomass accumulation at 45 days after treatment im-

Table 1. **Effect of treatments on area covered by weeds**

Treatment		Area covered by weeds (%)		
		1997	1998	1999
T1	Scraping entire platform	32.56 (28.98)*	36.35 (35.13)	25.05 (17.98)
T2	Slashing entire platform	48.28 (55.70)	55.75 (67.70)	41.81 (44.43)
T3	Spraying paraquat** + 2,4-D*** in the entire platform	36.53 (35.49)	42.33 (45.35)	28.03 (22.13)
T4	Spraying glyphosate**** in the entire platform	33.95 (31.11)	42.97 (46.46)	27.64 (21.56)
T5	Slashing interspaces and scraping plant basin	42.78 (46.13)	44.74 (49.54)	34.27 (31.73)
T6	Slashing interspaces and applying paraquat +2,4-D	42.00 (44.76)	44.63 (49.35)	36.27 (35.00)
T7	Slashing interspaces and applying glyphosate in plant basin	38.36 (38.53)	42.14 (45.00)	35.53 (33.78)
SE		1.83	1.59	1.20
CD (P=0.05)		5.43	4.72	3.56

* The figures are angularly transformed values. Original values are given in parentheses.
** Gramoxone 2.25 L/ha; *** Fernoxone 1.25 kg/ha; **** Round up 2L/ha

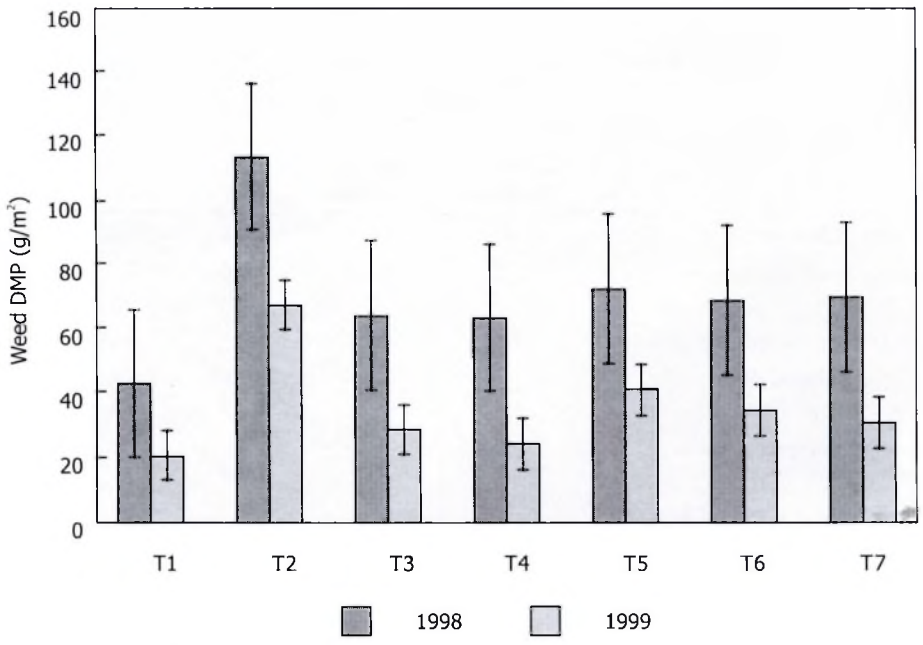

Fig. 1. Effect of weed management methods on weed biomass

position during 1998 and 1999 is depicted in Fig. 1. The weed coverage and dry matter production (DMP) in different treatments followed almost a similar trend in both the years. The data revealed that slashing resulted in poor weed control even through frequent rounds of weeding were done to keep down the weed infestation. The weed biomass was minimum in scraped plots. The weed DMP in all other treatments was comparatively low.

Effect on growth of rubber

The girth of rubber did not differ significantly among the treatments throughout the period under observation. The girth of the plants ranged from 15.55 to 17.95 cm, 22.10 to 24.70 cm and 30.62 to 34.75 cm with a mean of 16.76 cm, 23.56 cm and 33.05 cm during 1997, 1998 and 1999 respectively.

Bioefficacy and cost effectiveness

The economics and cost comparison of different weed management methods are presented in Table 2. Scraping gave good weed control with limited number of rounds of operation. (Tables 1 and 2). However, the operation was labour intensive and hence the total cost incurred was also high. Moreover, scraping exposes the soil and predisposes to erosion hazards, especially in the tropical rubber growing regions with frequent and intense rainfall. Slashing, though eco-friendly, needed more frequent weeding rounds to achieve desirable control due to which the manpower requirement and the total cost of operation were very high. Chemical weeding using the herbicides along the planting strip of rubber was found to be very efficient and cost effective compared to manual weed control through slashing and scraping

Table 2. **Economics of different weed management methods**

Treatment		Average annual requirement				
		No.of rounds of operation	No. of mandays/ ha/round	Labour wages (Rs.)	Cost of chemicals (Rs.)	Total cost (Rs.)
T1	Scraping entire platform	2	12	3000	-	3000
T2	Slashing entire platform	5.2	5	3250	-	3250
T3	Spraying paraquat** + 2,4-D*** in the entire platform	3.4	3	1275	649	1924
T4	Spraying glyphosate**** in the entire platform	2.8	3	1050	455	1505
T5	Slashing interspaces and scraping plant basin	3.2	7	2800	-	2800
T6	Slashing interspaces and applying paraquat + 2,4-D	3.4	4	1700	238	1938
T7	Slashing interspaces and applying glyphosate in plant basin	3.0	4	1500	176	1675

** Gramoxone 2.25 L/ha; *** Fernoxone 1.25 kg/ha; **** Round up 2L/ha

(Tables 1 and 2) and can be practised over a large area with limited labour input. Glyphosate was found to give long lasting control as is evident from the fewer rounds required and hence proved to be the most cost effective method among the different treatments. Glyphosate is a very effective systemic herbicide, which is commonly used for the control of many grass weeds. This herbicide alone and in combination with other herbicides were reported to be very cost effective (Chung, 1997; Chung *et al.*, 2000). The integrated weed control method of spraying glyphosate in the plant basin and slashing the weeds in the remaining area was found to be both cost effective and eco-friendly as the herbicidal load in the environment could be reduced considerably. The total cost of operation of this method was only marginally higher than spraying glyphosate in the entire planting strip, the most cost effective method.

The results of the present study confirmed that the application of glyphosate in the entire platform is the most cost effective method of weed management in the planting strips of rubber. However, when we consider the long term sustainable benefits, the integrated approach of spraying glyphosate in the plant basin and slashing the weeds in the remaining area, was found to be both cost effective and eco-friendly.

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