Indian Journal of Natural Rubber Research, 8(2) : 117-122, 1995

EFFICACY OF DIURON FOR WEED CONTROL IN RUBBER SEEDLING NURSERY

Radha Lakshamanan, K.I. Punnoose and M. Mathew

Lakshamanan, R., Punnoose, K.I. and Mathew, M. (1995). Efficacy of Diuron for weed control in rubber seedling nursery. *Indian Journal of Natural Rubber Research*, 8(2) : 117-122.

A field experiment was conducted to study the effectiveness of three doses of Diuron *viz.*, 1.0, 2.0 and 2.5 kg per ha for controlling weed growth in rubber seedling nursery. Application of diuron at the rate of 2.5 kg per ha at planting, could control weeds effectively for a period of 120 days and was significantly superior to the lower doses tried. Single application of diuron at the rate of 2.5 kg per ha gave a cost saving of 29.9 per cent over the manually weeded plots. Application of Diuron at the rate of (2.5 kg per ha) at planting followed by a second application at the rate of 1.0 kg per ha after two months controlled weeds effectively and resulted in a total weeding cost saving of 55.8 per cent over manual weeding. Herbicide application followed by mulching was also equally effective and economical in controlling weed growth. No phytotoxic effect was noticed on the seedlings from application of the herbicide.

Key words : Weed control, Seedling nursery, Diuron, Mulching, *Hevea*.

Radha Lakshmanan (for correspondence), K.I. Punnoose and M. Mathew, Rubber Research Institute of India, Kottayam - 686 009, Kerala, India.

INTRODUCTION

The main objective of a seedling nursery for rubber is to raise the maximum number of healthy and vigorous stock seedlings which would attain buddable girth within the shortest time. In order to achieve this, the plants must grow in a favourable environment without having to compete for light, water and nutrients. Restricting/controlling weed growth in rubber seedling nursery is thus a major factor that has to be given due importance since unchecked weed growth will ultimately restrict plant growth.

Manual weeding is the most common cultural practice followed for regulating weed growth in seedling nursery. However, utmost care is to be taken during manual weeding as the implements used for weeding may cause damage to the young plants. Further, the increased cost of manual weeding and the problems related to labour availability have made the prospects of using chemicals for weed control attractive. Use of diuron at 2 to 3 kg per ha has been reported to control both monocot and dicot weeds for a period of 2 to 3 months in seedling nursery (Mathew and Punnoose, 1975). Progressive reduction in weed growth with increasing levels of diuron was also reported (Mathew *et al.*, 1977).

Butani *et al* (1988) reported that when observed 30 to 90 days after application, diuron was most effective at the rate of 2 kg/ha. There was no phytotoxicity to peach seedlings. Diuron at the rate of 2 kg per ha applied at pre-emergence or early post-emergence stage controlled weeds effectively in nurseries of

several fruit trees for 4 to 5 months with no adverse effect on plant growth and was economical to hand weeding (Challa, 1990).

The present study was initiated to examine the efficacy and economics of chemical weed control in rubber seedling nursery with single and sequential application of diuron.

MATERIALS AND METHODS

A field experiment (Experiment 1) was conducted in a seedling nursery at the Central Nursery of Rubber Board at Karikattoor to study the efficacy of basal application of diuron with and without a second application in comparison with manual weeding and mulching. Diuron (Klass 80 WP) was used for the study. It is a colourless crystalline solid with 3-3, (4 - dichlorophenyl) - 1, l-dimethyl urea as active ingredient.

The experiment was laid out in a completely randomised block design with three replications. The treatment details are given in Table 1. The basal dose of the herbicide as per the treaments was sprayed on to the already prepared seed beds and the seeds were planted after an interval of five days. The second round of the herbicide application/mulching was done immediately after the first fertilizer application in November, 60 days after planting. As the fertilizers had to be incorporated into the soil, weed growth in all the plots were completely removed and its dry weight recorded. Herbicide was applied with a knapsack sprayer fitted with a flood jet nozzle (WFN - 40) using 600 litres of spray fluid per hectare. Mulching was done using used black polythene bags and a 0.5 cm thick layer of soil was placed over the mulch to keep it in place.

Weed dry matter production was recorded at periodic intervals after spraying the herbicide. The weed flora coverage was assessed at the final stage based on a subjective scale of 0 to 100 where '0' indicates complete absence of weeds and 100 complete coverage by weed.

Table 1. **Treatment details**

Treatments	Time of application
Experiment 1	
Diuron (kg/ha)	
1.0	Pre-plant
2.0	Pre-plant
2.5	Pre-plant
2.0 + 1.0	Pre-plant + post-emergence
2.0 + 2.0	Pre-plant + post-emergence
2.0 + mulch	Pre-plant
2.5 + 1.0	Pre-plant + post-emergence
2.5 + 2.5	Pre-plant + post-emergence
2.5 + mulch	Pre-plant
Mulch	—
Manual weeding	
Design : RBD	Replication : 3
Plot size : 10 x 10 m^2	
Experiment 2	
Diuron (Kg/ha)	
1.0	Post-emergence
2.0	Post-emergence
2.5	Post-emergence
Control (unsprayed)	
Design : RBD	Replication : 6
Plot size : 5 x 5 m^2	

To study the tolerance of rubber seedlings to diuron, a separate experiment with foliar spraying of the herbicide (Experiment 2) was initiated, the details of which are given in Table 1. Growth of rubber was evaluated at periodic intervals.

RESULTS AND DISCUSSION

The major weeds present in the experimental area were *Digitaria sanguinalis* (L.) Scop., *Panicum repens* L. and *Ischaemum indicum* (Houtt.) Merr. among the monocots,

Cyperus esculentus L. among the sedges and *Emmelia sonchifolia* L., *Euphorbia hirta* L., *Borreria aculeata* L., *Cleome viscosa* L. and *Vernonia cineria* L., among the dicots. About 70 per cent of the total weed population was dominated by monocots with *Digitaria sanguinalis* comprising around 95 per cent of the total population of monocots.

Pre-plant application

The data on weed dry matter production recorded at periodic intervals are given in Table 2. At two months after the basal application, diuron treatments at 2.0 and 2.5 kg per ha were significantly superior to 1.0 kg per ha and the control. The reduction in weed growth was 92, 86 and 65 per cent with diuron at 2.5, 2.0 and 1.0 kg per ha respectively over the control plots at this stage.

Table 2. **Weed dry weight (g/ m²) and weed coverage with diuron application at planting**

Diuron (kg/ha)	Months after application			
	2	3	4	8*
1.0	56.06	9.1	148.61	93.3
2.0	21.99	9.8	110.09	96.7
2.5	11.21	6.5	63.82	86.7
Control (Manual weeding)	156.26	12.34	142.45	95.0
SE±	7.48	0.77	8.85	9.25
CD (P = 0.05)	23.04	2.27	26.12	27.29

* Weed flora coverage based on a subjective scale of 0-100; 0 = absence of weeds; 100 = complete coverage with weeds.

The effectiveness of weed kill was reduced considerably with time, and by about three months after the initial spraying there was no significant difference for weed dry mater production between the 1.0 and 2.0 kg per ha plots. Weed control efficiency with diuron at 2.5 kg per ha was 57 per cent over the control plots and was significantly superior to the lower doses of the herbicide tried. Nevertheless, in all the herbicide treated plots weed growth was significantly less compared to control plots.

The low water solubility of diuron and its absorption by soil colloids reduces leaching losses and retains the applied diuron on the soil surface for a longer time. (Khan *et al.*, 1976; Thomson, 1984). At four months also the trend in efficacy of the doses remained but the efficacy of diuron at the rate of 1.0 kg per ha disappeared by this time and weed growth was similar to that in the control plots.

The effectiveness of the herbicide at all the three doses tried disappeared by eight months after the basal application.

Second round of spraying/mulching

At one month after the second round of diuron application, the treatments in which the second dose was superimposed over the basal doses, weed control was effective (Table 3). There was no statistical difference among the different combina-

Table 3. **Weed dry weight (g/m²) and weed coverage with repeat application of diuron and/or mulching**

Diuron (kg/ha)	Months after second application		
	1	2	5*
2.0 + 1.0	1.14	15.01	43.3
2.0 + 2.0	0.11	9.74	38.3
2.0 + Mulch	4.01	35.96	20.0
2.5 + 1.0	0.03	3.13	26.7
2.5 + 2.5	0.01	1.13	16.7
2.5 + Mulch	2.05	30.13	26.7
Mulch	6.74	55.46	31.7
Manual weeding	12.34	142.45	95.0
SE±	0.77	8.85	9.25
CD (P = 0.05)	2.27	26.12	27.29

* Weed flora coverage based on a subjective scale of 0-100; 0 = absence of weeds; 100 = complete coverage with weeds.

tions of herbicide doses though the extent of control was greater in the plots which received 2.5 kg per ha of diuron as basal application.

Mulching with black polythene also reduced weed growth. A basal application of 2.5 kg per ha followed by mulching was on par with the treatments in which herbicide was superimposed. Mulching alone with black polythene controlled weeds by 45 per cent over the control and was statistically significant.

At two months after the second application of the herbicide, basal application of 2.0 and 2.5 kg per ha followed by 1.0/2.0 kg per ha were statistically at par. The treatment 2.0 kg per ha followed by 1.0/2.0 kg per ha was statistically on par with the 2.0 and 2.5 kg per ha followed by mulching. There was no significant difference between basal application of the herbicide (2.0/2.5 kg/ha) followed by mulching and mulching alone.

Visual scoring of weed flora coverage was done at five months after the second herbicide application just before budding. All treatments were effective in minimising weed growth at this stage. The reduction in weed coverage with the different treatments ranged from 54 to 82 per cent over the control plots.

Effect on growth of rubber

The effect of application of the herbicide on plant growth, evaluated at the different stages, is shown in Table 4. The treatments did not show significant difference with respect to plant diameter. Application of diuron before planting or at two months after planting did not affect girthing of the plants adversely.

Tolerance of seedlings

Foliar spray of diuron at the three doses (1.0, 2.0 and 2.5 kg/ ha) on young rubber seedlings at three months after planting showed no significant difference from the unsprayed plots with respect to plant girthing and the number of buddable seedlings (Table 5). Diuron is absorbed primarily by roots and the movement is restricted to the apoplast and very little diuron is absorbed by the emerging shoot (Rao, 1988). Thus no visible symptoms of phytotoxicity was observed on spraying of diuron at the

Table 4. **Effect of diuron on plant diameter**

Diuron (kg/ha)	Plant diameter (cm) Months after planting		
	3	5	8
1.0	0.44	0.57	0.94
2.0	0.45	0.61	0.92
2.5	0.47	0.57	0.95
2.0 + 1.0	0.46	0.59	0.96
2.0 + 2.0	0.47	0.63	0.89
2.0 + mulch	0.45	0.62	1.02
2.5 + 1.0	0.44	0.58	0.94
2.5 + 2.5	0.43	0.60	1.00
2.5 + mulch	0.43	0.60	1.02
Mulch	0.44	0.58	0.99
Manual weeding	0.45	0.56	0.94
SE±	0.009	0.024	0.042
CD (P = 0.05)	NS	NS	NS

Table 5. **Effect of foliar spray of diuron on growth**

Diuron (kg/ha)	Plant diameter (cm) Pre-treatment	Months after application 1	4	Buddable seedlings (%)
1.0	0.55	0.68	0.98	62.3
2.0	0.58	0.67	0.89	70.6
2.5	0.55	0.67	0.97	62.8
Control	0.55	0.65	0.92	64.8
SE±	0.009	0.01	0.056	4.23
CD (P = 0.05)	NS	NS	NS	NS

post-emergence stage. Hence it can be safely used even after emergence of rubber seedlings in the nurseries.

Cost analysis

The total cost of manual/chemical weeding for one ha of nursery area was worked out (Table 6). The total cost per round of manual weeding alone was found to be Rs. 3320/- being the labour charges for 83 workers at the rate of Rs. 40/- per day. With three rounds of manual weeding that are generally adopted, the total cost per ha of seedling nursery works out to Rs. 9960/-.

With a single pre-plant application of the herbicide at 2.0 and 2.5 kg per ha, it is possible to eliminate the first round of manual weeding. Even at the time of the second round of weeding, the labour employment can be considerably reduced as the effect of the herbicide still persists, though to a lesser degree. For the third cycle of weeding, the effect of the herbicides having disappeared, manual weeding at the recommended task of three cents per worker per day would be necessary. The cost per ha with 2.0 kg basal application alone amounts to Rs. 7730/- and that with 2.5 kg to Rs. 6980/- resulting in a cost savings of 22.4 per cent and 29.9 per cent respectively.

Application of diuron at planting at the rate of 2.5 kg per ha followed by a post-emergence application at the rate of 1.0 and 2.5 kg per ha eliminated two rounds of manual weeding. The cost savings over manual weeding was 55.8 per cent and 49.4 per cent for diuron at 2.5 + 1.0 and 2.5 + 2.5 kg per ha respectively.

Application of a single dose of diuron (pre-plant) followed by mulching resulted

Table 6. **Weed control cost in rubber seedling nursery**

Treatments	Weeding cycles											
	I				II				III			
	No. of workers	Amount (Rs)	Cost of herbicide treatment (Rs.)	Total amount (Rs.)	No. of workers	Amount (Rs.)	Cost of herbicide treatment (Rs.)	Total amount (Rs)	No. of workers	Total amount (Rs.)	Mulching cost (Rs) **	Grand total
Manual weeding*	83	3320	--	3320	83	3320	--	3320	83	3320	---	9960.00
Diuron, 2kg/ha	--	--	1890	1890	63	2520	--	2520	83	3320	--	7730.00
Diuron, 2.5 kg/ha	--	--	2220	2220	36	1440	--	1440	83	3320	---	6980.00
Diuron, 2.5 kg+ 1.0 kg/ha	--	--	2220	2220	--	--	1065	1065	28	1120	---	4405.00
Diuron, 2.5 kg + 2.5 kg/ha	--	---	2220	2220	--	--	2220	2220	15	600	---	5040.00
Diuron, 2.5 kg + mulch	--	--	2220	2220	21	840	--	840	28	1120	3000	7180.00
Mulch alone	83	3320	--	3320	31	1240	--	1240	28	1120	3000	8680.00

I =6-8 weeks after planting; II = 6-8 weeks after first weeding; III = At the time of budding + Labour task for manual weeding - 3 cents/worker/day

** Labour task for polythene mulching - 5 cents/worker/day + cost of material @ Rs. 1000 per ha

Cost of herbicide - Rs. 660 per kg formulation + Rs. 240 per ha application cost.

in a total cost per ha of Rs. 7180/-. With mulching alone the total cost per ha was Rs. 8680/-.

The study revealed that application of diuron at the rate of 2.5 kg per ha at planting followed by a second application at 1.0 kg per ha or mulching controlled weeds till the time of budding and was economical to manual weeding.

REFERENCES

Bhutani, V.P., Sharma, M.M. and Joolka, N.K. (1988). Chemical weed control in peach nursery. *Indian Journal of Weed Science*, 20(1) : 5-9.

Challa, P. (1990). Chemical weeding as a labour saving device in management of fruit nurseries. *Abstracts of the International Seminar on New Frontiers in Horticulture*, 25-28 November 1980, IAHS, Bangalore, India, pp. 14.

Khan, S.U., Marriage, P.S. and Saidak, W.J. (1976). Persistence and movement of diuron and 3, 4-dinitroaniline in orchard soil. *Weed Science*, 24 : 583-586.

Mathew, M. and Punnoose, K.I. (1975). A study on the comparative effect of some pre-emergence weedicides on the control of weeds in rubber plantations. *Rubber Board BullettinI*, 12(4) : 136-137.

Mathew, M., Punnoose, K.I. and Potty, S.N. (1977). Report on the results of chemical weed control experiments in rubber plantations in South India. *Journal of Rubber Research Institute of Sri Lanka*, 54 : 478-488.

Rao, V.S. (1988). Absorption and translocation of herbicides. In : *Principles of Weed Science*. Oxford and IBH Publishing Co., New Delhi, pp. 91-124.

Thomson, W.T. (1984). Agricultural chemical book : 2. Herbicides. Thomson Publication, California, pp. 144-146