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Efficacy of herbicide spray as an alternative to manual weeding in pearlmillet (*Pennisetum glaucum*)

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ABSTRACT

A field experiment conducted during the rainy seasons (*kharif*) 1988 and 1989 indicated that the pre-emergence spray of atrazine @ 0.5 or terbutryne @ 0.4, 0.6 and 0.8 kg a.i./ha reduced the density and dry weight of weeds in pearlmillet [*Pennisetum glaucum* (L.) R. Br. emend. Stuntz]. These treatments were on a par with hand-weeding. The uncountrolled weed growth reduced the number of tillers, ears/plants and the test weight. Unit increase in weed density/m^2 reduced the grain yield of pearlmillet by 7.7 kg in 1988 and 8.1 kg/ha in 1989. The dry weight of weeds/m^2 reduced the yield by 4.3 and 5.1 kg/ha. Pre-emergence spray of atrazine @ 0.5 or terbutryne @ 0.6 kg a.i./ha was the most effective alternative to hand-weeding in labour-scarce situation.

Crop–weed competition 1 month after sowing poses a serious threat to the production of pearlmillet [*Pennisetum glaucum* (L.) R. Br. emend. Stuntz] (Verma *et al.*, 1989). Farmers generally accomplish this through hand-weeding. Recently, there has been an enormous migration of labour to industrial sectors in urban areas, resulting scarcity of labour particularly during the peak periods of farm operations. The crux of the problem is further accentuated in situations where rainfall span prolongs for a longer period and hinders the weeding operation in the crop. Under these circumstances, the use of herbicides appear promising. Hence the present investigation was carried out on these aspects.

MATERIALS AND METHODS

The field experiment was conducted at Palem during the rainy seasons (*kharif*) of 1988 and 1989. The soil was an Alfisol. It was slightly alkaline in reaction (7.8 pH), low in available nitrogen (180 kg N/ha) and medium in available phosphorus (19 kg P_2O_5/ha) and potassium (198 kg K_2O/ha). The variety of the crop was 'RBS 2'. Plants were spaced 45 cm between and 15 cm within the rows. Fertilizers were applied @ 60 kg/N and 30 kg P_2O_5/ha.

The layout was randomized block design. The plots were 4.0 m wide and 6.0 m long. There were 3 replications and 7 treatments. Hand-weeding 4 weeks after sowing was the basic treatment, which was compared with herbicide sprays of atrazine @ 0.5 and terbutryne @ 0.4, 0.6 or 0.8 kg a.i./ha. A weed-free and an unweeded check were the additional treatments. The weed-free condition was maintained through repeated

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hand-weedings. Herbicides were sprayed pre-emergence to weeds on the following day after sowing. Hand-operated knapsack sprayer fitted with flat-fan nozzle was used. The discharge fluid was calibrated to 500 litres/ha. Weeds were counted and the dry matter was recorded from quadrats of 0.5 m × 0.5 m from 3 random spots in each treatment at 60 days after sowing and harvest. The data on weed density/m^2 was transformed to square roots. Weed-control efficiency of the treatments was calculated in relation to the weedy check both for weed density and dry matter as per Patil and Patil (1983). Weed index was calculated to assess the effect of herbicides on crop yield in relation to hand-weeding (Gill and Vijaya Kumar, 1969). Correlation coefficients and linear regression models were worked out to evaluate the competitive effect of weed density and dry weight at 60 days after sowing on grain yield. The pooled analysis of variance was also done for yield data. Statistical procedures were adopted form Zaman *et al.* (1982).

RESULTS AND DISCUSSION

The major weed flora observed in experimental plots consisted of *Trianthema portulacastrum* L., *Echinochloa colonum* (L.) Link., *Cyperus rotundus* (L.) Pers., *Digeria arvensis* (L.) Forsskal and *Dactyloctenium aegypticum* (L.) Willd.

Atrazine sprayed @ 0.5 and terbutryne @ 0.4, 0.6 or 0.8 kg a.i./ha reduced the weed density and dry weight/m^2, being on a par with the hand-weeding treatment (Table 1). The weed-control efficiency of these treatments was more in terms of dry weight. It was 93.1–96.3 and 95.5–96.8% during 1988 and 1989 respectively. Verma *et al.* (1989) also reported that the pre-emergence spray of atrazine @ 0.5 kg a.i./ha reduced the density and dry weight of weeds. The uncontrolled weeds affected the crop drastically. The crop produced significantly less number of tillers and ears/plants. The test weight of seed was also significantly less than in weed control or weed-free treatments in both the years (Table 2). These ill-effects are due probably to the competitive stress for available resources to be shared by the crop and weeds.

The uncontrolled weeds reduced the stover yield significantly (Table 2). It was limited to about 70% of the yield due to hand-weeding in both the years. The effect of atrazine @ 0.5 or terbutryne @ 0.4 and 0.6 kg a.i./ha was at par with hand-weeding. But at a high rate of 0.8 kg a.i./ha, terbutryne reduced the stover yield which was at par with the weedy check in 1989.

The density and dry weight of weeds established negative and highly significant correlation with the grain yield pearlmillet The regression coefficients showed that the yield reduced by 7.7 and 8.1 kg/ha per unit increase in weed density/m^2 in 1988 and 1989 respectively. This loss described by the linear regression models accounted for 88 and 95% of the total variance in the 2 years. Increase in dry matter of weeds g/m^2 also accounted for a linear reduction in yield by 5.7 kg/ha in 1988 and by 4.3 kg/ha 1989. The fitted regression equations explained 83 and 91% of the total variability (Table 3). Weed density and dry weight are therefore the critical parameters that have direct bearing in limiting the yield of pearlmillet. Thus the weed index was 36.9 and 38.3 in 1988 and 1989 respectively when weeds were not controlled. Hand-weeding once 4 weeks after sowing increased the grain yield at par with the weed-free treatment. The

Table 1. Effect of weed-control treatments on density and dry matter of weeds/m² and weed-control efficiency

Treatment (kg a.i./ha)	Weed density/m²				Weed-dry weight (g/m²)				Weed-control efficiency (%)			
	60 DAS		Harvest		60 DAS		Harvest		60 DAS		Harvest	
	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989
Weed-free	0.0 (1.0)	0.0 (1.0)	0.0 (1.0)	0.0 (1.0)	0.0	0.0	0.0	0.0				
Hand-weeding 4 WAS	18.36 (4.4)	37.44 (6.2)	24.0 (5.0)	37.44 (6.2)	8.1	12.0	11.1	12.5	95.9	96.4	94.4	96.5
Terbutryne @ 0.4	19.25 (4.5)	39.96 (6.4)	33.81 (5.9)	39.96 (6.4)	10.4	15.0	13.6	15.5	94.7	95.5	93.1	95.6
Terbutryne @ 0.6	17.49 (4.3)	31.49 (5.7)	19.25 (4.5)	32.64 (5.8)	7.7	11.4	8.2	11.3	96.0	96.6	95.9	96.8
Terbutryne @ 0.8	15.81 (4.1)	27.09 (5.3)	15.0 (4.0)	30.36 (5.7)	7.6	11.6	9.4	12.6	96.1	96.5	95.3	96.4
Atrazine @ 0.5	16.64 (4.2)	29.25 (5.5)	18.36 (4.4)	31.49 (5.7)	7.2	11.2	8.4	13.1	96.3	96.7	95.8	96.3
Weed check	162.64 (12.8)	206.36 (14.4)	122.21 (11.1)	200.64 (14.2)	195.2	335.4	198.6	354.5				
CD (P = 0.05)	1.6	1.2	2.6	1.8	10.2	24.7	7.9	17.4				

Data in parentheses are the $\sqrt{X + 1}$ transformed values
WAS, Weeks after sowing

Table 2. Effect of different treatments on yield-contributing characters and yield of pearlmillet

Treatment (kg a.i./ha)	Tillers/plant		Ears/plant		Test weight		Grain yield (q/ha)		Weed index		Stover yield (q/ha)	
	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989
Weed-free	3.50	3.52	3.00	3.08	7.00	7.10	31.7	37.5			102.6	125.7
Hand-weeding 4 WAS	3.10	3.34	2.76	2.80	6.35	6.45	28.8	34.1			90.9	122.1
Terbutryne @ 0.4	3.08	3.30	2.60	2.76	6.40	6.50	25.7	32.8	10.6	3.8	79.3	106.9
Terbutryne @ 0.6	3.30	3.44	2.82	2.90	6.20	6.35	29.0	35.1	—0.9	—2.7	82.2	110.2
Terbutryne @ 0.8	3.00	3.25	2.50	2.65	5.94	6.10	26.9	33.0	6.5	3.4	78.0	100.6
Atrazine @ 0.5	3.20	3.40	2.91	2.92	6.15	6.20	30.3	36.8	—5.3	—7.8	92.8	104.8
Weed check	1.70	1.40	1.60	1.20	5.12	5.00	18.2	21.1	36.9	38.3	63.9	86.0
CD (P = 0.05)	0.45	0.47	0.40	0.42	0.80	0.84	4.8	4.5			20.1	18.1

Table 3. Correlation coefficients and linear regression models for weed density and dry matter/m^2 at 60 days after sowing versus grain yield of pearlmillet

Year	r	r^2	Y = a + bx	
			a	b
		Weed density/m^2 vs grain yield		
1988	—0.938**	0.880	30.629	—0.077^x
1989	—0.974**	0.948	38.043	—0.081^x
		Weed-dry weight/m^2 vs grain yield		
1988	—0.910**	0.829	29.185	—0.057^x
1989	—0.955**	0.913	35.358	—0.043^x

weed index due to pre-emergence spray of atrazine @ 0.5 kg a.i./ha was least followed by terbutryne @ 0.6 kg a.i./ha in both the years. Grain yield from these herbicide treatments was also on a par with the weed-free treatment. The pooled analysis of variance for mean yield also revealed similar effect of these weed-control treatments.

It was concluded that under labour-scarce situation and condition not suitable for hand-weeding, pre-emergence spray of atrazine @ 0.5 or terbutryne @ 0.6 kg ai/ha are the suggested alternatives.

REFERENCES

Gill, G. S. and Vijaya Kumar. 1969. Weed index — a new method for reporting weed control trials. *Indian Journal of Agronomy* **14** : 96–98.

Patil, V. C. and Patil, S. V. 1983. Studies on weed control in Bamboo. *Indian Journal of Weed Science* **15** (1) : 83–86.

Verma, O. P. S., Midha, L. K. and Katyal, S. K. 1989. Studies on competitive behaviour of pearlmillet and associate weeds. *Indian Journal of Agronomy* **34** (4) : 410–412.

Zaman, S. M. H., Rahim, K. and Howlader, M. 1982. *Simple Lessons from Biometry*, pp 106–115. Bangladesh Rice Research Institute, Joydebpur, Dhaka, Bangaladesh.