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Weed management studies with pre-emergence Isoproturon in rainfed direct sown finger millet *(Eleusine coracana* Gaertn.)

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Abstract: Field experiment conducted at Tamil Nadu Agricultural University, Coimbatore in finger millet during the rainy season of 1998 and 1999 revealed that two intercultivations at 20 and 40 days after sowing (DAS) + one hand weeding on 35 DAS or pre-emergence application of Isoproturon @ 0.5 kg ai ha^{-1} as spray effectively controlled the weeds resulting in lesser weed population and weed dry matter production (DMP), which in turn favourably influenced the yield attributes, yield and economic returns of rainfed finger millet compared to other weed control treatments. The unweeded check recorded the maximum weed population and weed DMP and hence, resulted in drastic yield reduction in finger millet under rainfed conditions. *(Key words: Weed management, Pre emergence)*

Weed infestation in rainfed finger millet is one of the major hurdles which limits its productivity level. Finger millet being a slow grower, needs weed free period upto 40 days (Gupta, 1993). While two to three intercultivations help in checking the weed growth, additional one hand weeding helps in achieving desired level of weed control. However, this practice is laborious, costly, tedious and time consuming. The use of herbicides for control of weeds in finger millet has been found effective. Post emergence application of 2,4-D Na-salt @ 0.75 kg a.i ha^{-1} was found to be effective for control of weeds in finger millet and resulted in increased grain yield (Krishne Gowda *et al.* 1997; Jena and Tripathy, 1997). Hence to study the effect of different weed management practices with pre-emergence isoproturon on weed control efficiency, finger millet yield and economics, the present study was undertaken.

Materials and Methods

The experiment was conducted at Millet Breeding Station, Tamil Nadu Agricultural University, Coimbatore during the rainy *(kharif)* season of 1998 and 1999. The soil was sandy clay loam in texture with pH 8.0, EC of 0.41 dSm^{-1} and soil available N, P and K of 152, 11.3 and 25.2 kg ha^{-1}, respectively. The experiment was laidout in a randomised block design with four replications adopting a spacing of 22.5 x 10 cm. The treatments consisted of :

T_1 : Pre-emergence Isoproturon @ 0.50 kg ha^{-1} as spray

T_2 : Pre-emergence Isoproturon @ 0.5 kg ha^{-1} applied with sand

T_3 : Pre-emergence Isoproturon @ 0.5 kg ha^{-1} applied with soil

T_4 : Pre-emergence Isoproturon @ 0.5 kg ha^{-1} applied with 1% $CaSO_4$

T_5 : Two intercultivations with rotary weeder at 20 and 40 DAS+ handweeding on 35 DAS

T_6 : Unweeded control

In treatment T_4, 1 per cent solution of $CaSO_4$ (gypsum) was mixed with Isoproturon, with the objective of reducing phytotoxicity of the herbicide under rainfed condition. In treatment T_5, two intercultivations with rotary weeder was given on 20 and 40 DAS between the inter rows and one hand weeding on 35 DAS to remove the weeds in the intrarows. CO 13 variety of fingermillet was sown on 20.07.1998 and 18.8.1999 and harvested on 6.11.1998 and 13.12.1999 respectively in 1998 and 1999. Recommended dose of fertilizers i.e. 60 kg N, 30 kg P_2O_5 and 30 kg K_2O ha^{-1} were applied through urea, single superphosphate and muriate of potash, respectively. Entire dose of P and K and half of N were applied as basal at the time of sowing and remaining half of N was top dressed on 35h day after sowing. The crop was grown under

Table 1. Effect of treatments on weed population and weed dry matter production in finger millet

Treat-ments	*Trianthema portulacastrum* population (No. m^2)				Total weed population (No. m^2)				Weed DNW (g m^2)				WCE	
	1998		1999		1998		1999		1998		1999		Mean of 1998 & 1999	
	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS
T_1	22.2	31.0	11.5	18.6	40.0	51.5	20.5	36.8	12.5	37.0	11.5	35.7	88.3	72.8
T_2	45.5	48.2	43.0	49.7	72.2	83.0	50.8	66.7	27.8	38.4	30.5	50.1	71.5	67.2
T_3	50.2	54.5	48.3	54.4	83.5	92.0	54.8	78.8	33.0	47.0	34.6	52.2	66.9	63.1
T_4	26.7	41.0	34.3	41.5	47.7	70.2	43.3	58.3	22.1	43.3	26.5	39.6	76.2	69.0
T_5	20.2	23.7	10.5	15.4	31.5	43.7	17.8	32.8	9.7	34.5	10.1	33.1	90.3	74.7
T_6	137.5	134.7	150.5	241.7	199.7	219.7	169.7	230.3	100.5	128.0	103.8	140.2	0.0	0.0
CD	8.2	6.8	15.3	20.4	15.38	14.44	20.4	16.5	3.67	6.90	12.4	18.3	-	-

Table 2. Effect of treatments on plant height, yield attributes, yield and economics of finger millet (Pooled mean of two years)

Treat ments	Plant height (cm)	Productive tillers	No.of fingers	Finger length (cm)	1000 grain weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Net return (Rs. ha^{-1})	B/C ratio
T_1	107.7	7.30	9.0	10.2	1.85	2758	3425.7	11,366	3.16
T_2	103.7	6.15	7.5	9.1	1.79	2280	2638.7	8450	2.61
T_3	101.6	5.15	6.2	8.7	1.79	2259	2759.1	8395	2.59
T_4	103.0	6.45	7.7	9.5	1.84	2263	2935.0	8715	2.65
T_5	109.5	7.85	9.7	10.8	1.76	2964	4305.3	13,063	3.27
T_6	85.7	3.30	5.2	7.8	1.74	469	1888.7	1996	0.72
CD	5.39	1.45	0.88	0.52	0.13	332.62	579.3	-	-

rainfed condition, and rainfall of 581 mm and 433 mm were received during 1998 and 1999 seasons. Weed population per m^2 and weed DMP were recorded on 30 and 60 days after sowing during 1998 and 1999. Weed control efficiency (WCE) was worked out using the formula

$$WCE = \frac{\text{Weed DMP in control plot - Weed DMP in treatment plot}}{\text{Weed DMP in control plot}} \times 100$$

Data on weed characters are presented in Table 1.

Observations recorded on plant height, yield attributes and yield of finger millet were analysed and pooled statistical analysis was also done and mean data along with economics is presented in Table 2.

Results and Discussion

Annual broad leaved weeds like *Trianthema portulacastrum and Boerhaavia diffusa* and grass weed *Dactyloctenium aegytium* were the major weeds in the experimental field. Of these, *Trianthema portulacastrum* (Carpet weed) was the predominant weed species contributing to nearly 95% of the total weed population.

Effect of treatments on weed (Table 1)

Results revealed that the population of *Trianthema portulacastrum* as well as total weed

population per m^2 and total weed dry matter production per M^2 were significantly lower in the treatment of two intercultivations at 20 and 40 DAS + one hand weeding on 35 DAS (T_5) and pre-emergence application of Isoproturon @ 0.5 kg ha^{-1} as spray (T_1), compared to other weed control treatments. This could be attributed to effectiveness in control of weeds in these treatments and also due to selectivity and efficiency of Isoproturon applied as water spray. Weed control efficiency (WCE) followed a similar trend and was highest in T_5 followed by T_1, because of effective weed control and lesser weed DMP recorded in these treatments compared to other treatments. Isoproturon with soil, sand and $CaSO_4$ caused phytotoxicity due to nonuniforinity in application. The unweeded check (T_6) recorded the highest population of *Trianthema portulacastrum,* as well as total weeds with highest weed DMP.

Effect of treatments on finger millet (Table 2)

Compared to all other weed control treatments, plant height, yield attributes, grain yield and economics were significantly higher in the treatments of two intercultivations at 20 and 40 DAS + hand weeding on 35 DAS (T_5) and pre-emergence application of Isoproturon @ 0.5 kg a.i/ha as spray (T_1). Krishne Gowda *el al.* (1997) and Jena and Tripathi (1997) also indicated that heribicides were as efficient as cultural methods of weed control in finger millet. Significantly lower plant height, yield attributes and yield were recorded in the unweeded check (T_6). The yield reduction in T_6 compared to T_5 was to the tune of 84 per cent (469 kg ha^{-1} in T_6 compared to 2964 kg ha^{-1} in T_5). Tiwari and Trivedi (1985) have also stated that in soybean, yield reduction ranged from 10 to 86 per cent depending upon weed infestation. There are also earlier reports of complete crop failure due to weeds, particularly in upland rice and vegetable crops (Friesen and Kanwar, 1983, Mukhopadhyay, 1992). The significant yield reduction recorded in unweeded check is due to the severe competition exerted by weeds for nutrients, light, moisture and space as reported earlier by Ulaganathan *et al.* (1992).

The results of the study revealed that two intercultivations with rotary weeder at 20 and 40 days after sowing (DAS) + one hand weeding on 35 DAS or pre-emergence application of Isoproturon @ 0.5 kg ai ha^{-1} as spray effectively controlled the major weed flora *Trianthema portulacastum,* the total weeds with increased weed control efficiency. The above treatment recorded higher grain and straw yield, with increased net return and B/C ratio in rainfed direct sown finger millet.

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