



Weed management in pearl millet based intercropping system

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Pearl millet [*Pennisetum glaucum* (L.) Br. *emend Stuntz.*] is an important coarse grain cereal crop of dry land agriculture. It can be grown on light textured soil under low moisture conditions as sole as well as with mothbean and cluster-bean in inter-cropping system in arid and semi-arid region of Rajasthan. Besides other production constraints, weed infestation is considered as one of the most important constraints to limit the yield in the pearl millet based inter-cropping systems. Being the rainy season cropping system, it may be infested severely with different kind of weeds which may reduce the yield of pearl millet and inter crops. Several workers like Singh and Yadav (1994), Ram *et al.* (2005) reported weed management in sole pearl millet but information regarding the control of weeds in pearl millet based inter-cropping system is scarce, particularly by herbicide. Keeping these points in view, the present study was under taken.

A field experiment was conducted at Agronomy Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during *Kharif* 2007. The soil was sandy loam in texture, low in organic carbon (0.08%) and available N (86.4 kg/ha), medium in P (21.9 kg/ha) and high in K (234.0 kg/ha) contents with a pH of 8.5. There were 21 treatments consisting of 3 treatments of intercropping (pearl millet sole, pearl millet + clusterbean and pearl millet + mothbean) and 7 treatments of weed control (weedy check, weed free, hand weeding once at 25 DAS, hand weeding twice at 25 and 45 DAS, pendimethalin at 0.75 kg/ha, oxyfluorfen at 0.1 kg/ha and oxyfluorfen at 0.2 kg/ha). The treatments were replicated thrice in factorial randomized block design. Crops were sown on 17 July, 2007 in lines spaced 60 cm in pearl millet and 30 cm in inter-cropping treatments by 'Kera' method in open furrow. A basal dose of N (20 kg/ha) and P (20 kg/ha) were drilled uniformly before sowing and remaining 20 kg N/ha was top dressed in the rows of pearl millet only. Weed density and dry weight was recorded by put-

ting a quadrat (0.25 m²) at random spots at two places in each plot. The total rainfall during the crop season was 121.9 mm.

Weed flora of the experimental field consisted of *Tribulus terrestris* L., *Cenchrus biflorus*, *Corchorus tridense*, *Cyperus* spp., *Euphorbia microphylla*. However, the predominant weeds were *Tribulus terrestris*, *Cenchrus biflorus* and *Corchorus tridense*.

The density and dry weight of total weeds were significantly reduced in both the inter-cropping systems compare to sole cropping of pearl millet (Table 1). Among the individual weeds, pearl millet + mothbean inter-cropping system reduced the density of *Tribulus terrestris* and *Cenchrus biflorus* significantly over sole cropping of pearl millet. All the growth parameters, *viz.* plant height, dry matter accumulation, root weight and length and yield attributing characters, *viz.* effective tillers/plant, length of ear and test weight of pearl millet were non-significant among different inter-cropping treatments hence, seed and stover yield of pearl millet was also found non-significant among inter-cropping of clusterbean/mothbean and sole pearl millet. The pearl millet equivalent yield and net return was significantly higher in both the inter-cropping systems compared to sole pearl millet but yield of inter-cropping of pearl millet either with mothbean or clusterbean were non-significant (Table 1) among themselves.

All the weed control measures decreased the density and dry weight of individual as well as total weeds significantly over weedy check. Pendimethalin at 0.75 kg/ha significantly reduced the density and dry weight of individual as well as total weeds significantly over oxyfluorfen at 0.1-0.2 kg/ha as pre-emergence. Hand weeding twice at 25 and 45 DAS significantly reduced density and dry weight of individual as well as total weeds compared to all other treatments and was statistically at par with weed free treatment. Hand weeding once at 25 DAS also reduced the density and dry weight of individual and total weeds as compared to oxyfluorfen at 0.1-0.2 kg/ha. Weed control treatments had significant effect on plant stand of

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pearlmillet (Table 1). Pendimethalin at 0.75 kg/ha and oxyfluorfen at 0.2 kg/ha significantly reduced the plant stand of pearl millet as compared to weed free treatment at 25 DAS and at harvest. This might be due to some phytotoxic effects of these herbicides on pearl millet (Yadav *et al.* 2004). All the mechanical treatments had almost similar plant stand as that of weed free treatment.

Application of pendimethalin and oxyfluorfen (0.2 kg/ha) also reduced the plant height of pearl millet significantly over all other treatments of weed control at 20 DAS (Table 1). It means that pendimethalin and oxyfluorfen (0.2 kg/ha) had some phytotoxic effect on pearl millet. At 45 DAS and at harvest, significantly lower plant height of pearl millet was observed in pendimethalin and oxyfluorfen at 1.0-2.0 kg/ha compared to weed free with different reasons. Reduction in plant height in pendimethalin 0.75 kg/ha and oxyfluorfen at 0.2 kg/ha was due to some phytotoxic effect as evident from the observation taken at 20 DAS. Both the treatments reduced the weeds significantly and could be comparable with one hand weeding at 25 DAS, but plant height of pearl millet reduced in the oxyfluorfen at 0.1 kg/ha treated plots which was due to the poor control of weeds by this treatment. The dry matter of pearl millet roots significantly influenced by weed control treatments at 20 and 40 DAS. Pendimethalin at 0.75 kg/ha applied as pre-emergence significantly reduced the root length of pearl millet at 45 DAS compared to all other treatments.

Similarly, dry matter production of pearl millet was also affected by weed control treatments. At 20 DAS, significantly lower dry matter of pearl millet was recorded in pendimethalin and oxyfluorfen at 0.2 kg/ha treatments compared to all other weed control treatments. At 45 DAS and at harvest, significantly lower dry matter was also produced by these two treatments compared to weed free and hand weeding, but it was significantly higher than weedy check. This might be due to phytotoxic effect of these treatments on pearl millet. However, oxyfluorfen at 0.1 kg/ha also recorded significantly lower dry matter of pearl millet at 45 DAS and at harvest compared to all other weed control treatments. This might be due to poor control of weeds in this treatment.

All the weed control treatments significantly increased the grain and stover yield of pearl millet over weedy check (Table 2). Weed free treatment recorded the maximum grain and pearl millet equivalent yield and consequently net return closely followed by hand weeding twice. Significantly higher grain and pearl millet equivalent yield was obtained in pendimethalin and oxyfluorfen treated plots compared to weedy check but these herbicidal treatments produced significantly lower yield than weed free and two hand weeding, inspite of good weed control. This might be due to some phytotoxic effect on pearl millet as evident from root study of pearl millet.

Table 1. Effect of intercropping and weed control treatments on growth attributes of pearl millet

Treatment	Plant stand (x10 ⁵ /ha)		Plant height (cm)			Drymatter production (g/plant)			Root weight (g)		Length (cm)
	At 25 DAS	At harvest	20 DAS	45 DAS	At harvest	20 DAS	45 DAS	At harvest	20 DAS	40 DAS	45 DAS
<i>Intercropping</i>											
Pearlmillet sole crop	1.84	1.75	48.77	147.48	152.62	1.23	17.82	27.73	0.40	4.88	29.15
Pearlmillet + cluster bean	1.78	1.73	48.36	147.77	152.17	1.18	16.96	27.41	0.38	5.05	29.08
Pearlmillet + moth bean	1.78	1.74	48.20	146.96	151.85	1.18	16.47	26.61	0.38	4.90	29.12
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
<i>Weed control</i>											
Weedy check	1.95	1.86	50.13	139.14	144.11	1.37	12.63	20.01	0.43	4.01	31.97
Weed free	1.97	1.94	51.03	152.88	157.70	1.39	20.84	32.67	0.44	5.30	32.66
Hand weeding once at 25 DAS	1.95	1.90	50.91	150.92	155.46	1.37	18.58	29.93	0.43	5.23	32.43
Hand weeding twice at 25 and 45 DAS	1.89	1.87	50.49	152.18	156.62	1.35	18.49	31.09	0.44	5.21	32.43
Pendimethalin at 0.75 kg/ha (pre-emergence)	1.47	1.43	45.20	146.59	151.55	0.94	16.59	26.77	0.26	5.80	10.50
Oxyfluorfen at 0.1 kg/ha (pre-emergence)	1.82	1.70	48.83	143.07	148.03	1.13	14.56	21.68	0.43	5.10	31.88
Oxyfluorfen at 0.2 kg/ha (pre-emergence)	1.55	1.47	42.49	147.05	152.02	0.84	17.89	28.61	0.30	4.92	31.96
LSD (P=0.05)	0.10	0.11	2.16	4.21	5.03	0.03	1.03	1.75	0.04	0.47	0.32

DAS= Days after sowing

Table 2. Effect of intercropping and different weed control treatments on yields of pearl millet

Treatment	Grain yield (t/ha)	Stover yield (t/ha)	Biological yield (t/ha)	Intercrop equivalent yield (t/ha)	Pearlmillet grain equivalent yield (t/ha)
<i>Intercropping</i>					
Pearlmillet sole crop	2.35	4.94	7.29	-	2.33
Pearlmillet + clusterbean	2.28	4.81	7.09	0.85	3.13
Pearlmillet + mothbean	2.31	4.86	7.17	0.83	3.13
LSD (P=0.05)	NS	NS	NS	-	0.28
<i>Weed control</i>					
Weedy check	1.48	3.87	5.35	0.42	1.90
Weed free	2.76	5.68	8.45	0.63	3.39
Hand weeding once 25 DAS	2.59	5.32	7.92	0.61	3.12
Hand weeding twice at 25 and 45 DAS	2.64	5.40	8.05	0.62	3.26
Pendimethalin at 0.75 kg/ha	2.27	4.64	6.92	0.58	2.99
Oxyfluorfen at 0.1 kg/ha	1.97	4.22	6.19	0.45	2.42
Oxyfluorfen at 0.2 kg/ha	2.45	4.97	7.42	0.51	2.96
LSD (P=0.05)	1.75	3.23	4.03	-	1.98

Table 3. Effect of intercropping and different weed control treatments on N, P uptake and net returns by pearl millet

Treatment	N uptake (kg/ha)		P uptake (kg/ha)		Net returns (x10 ³ ₹/ha)
	Grain	Stover	Grain	Stover	
<i>Intercropping</i>					
Pearlmillet sole crop	34.52	23.87	6.49	5.58	16.70
Pearlmillet + clusterbean	35.36	23.58	6.49	5.62	23.13
Pearlmillet + mothbean	35.15	23.87	6.49	5.61	21.14
LSD (P=0.05)	NS	NS	NS	NS	2.39
<i>Weed control</i>					
Weedy check	18.76	16.70	3.82	3.98	12.60
Weed free	44.56	29.21	8.08	6.83	24.43
Hand weeding once 25 DAS	39.56	26.22	7.16	6.22	23.74
Hand weeding twice at 25 and 45 DAS	42.15	27.47	7.66	6.46	23.75
Pendimethalin at 0.75 kg/ha	35.97	22.88	6.48	5.43	20.12
Oxyfluorfen at 0.1 kg/ha	25.67	19.60	5.31	4.61	16.38
Oxyfluorfen at 0.2 kg/ha	38.41	24.33	6.90	5.72	21.22
LSD (P=0.05)	2.63	1.81	0.54	0.48	1.69

Weeding was associated with no or lower dry matter production of weeds under these treatments. Further, in weed free and hand weeding treatments, weeds were removed manually with the help of hand hoe, which makes the soil porous and creates favourable environment for growth in addition to effective control of weeds. The favourable effect of weed control on account of reduced weed crop competition under these treatments led to significant increased in various yield parameters, viz. num-

bers of effective tillers, length of ear and test weight. Further, contribution of weed control measures towards the important yield attributes could be owing to their effect on reducing crop weed competition and increasing the weed control efficiency and hence, better utilization of inputs by crop plants. Ram *et al.* (2005) also reported improvement in yield components due to elimination of severe crop weed competition.

N uptake by crop recorded under all the weed control measures was significantly higher over weedy check (Table 3). The maximum uptake of N and P by crop up to harvest was observed under weed free closely followed by hand weeding twice which effectively controlled and suppressed the weed growth and thereby provided almost weed free environment to the crop to utilize the available nutrients. Thus increase in crop dry matter with a concomitant increase in its nitrogen and phosphorus content seems to be responsible for increased uptake of nitrogen and phosphorus by crop under these treatments. Similar findings were also reported by Sreenivas and Satyanarayan (1996) and Ram *et al.* (2005). Nitrogen and phosphorus uptake by pearl millet grain and stover were also not affected significantly by intercropping system.

SUMMARY

A field experiment was conducted during *Kharif* season of 2007 to study the weed management in pearl millet inter-cropping systems. The experiment was laid out in factorial randomized block design and replicated three times. Pre-emergence application of pendimethalin at 0.75kg/ha and oxyfluorfen at 0.2 kg/ha decreased the crop growth and yield attributes, *viz.* plant stand, plant height,

dry matter production, root weight and root length compared to two hand weeding due to some phytotoxic effect but superior to one hand weeding and weedy check. Significantly higher seed, stover, biological and pearl millet equivalent yield were recorded in two hand weeding treatment over all other treatments except weed free. The N and P uptake of pearl millet and net returns increased significantly under all the weed control treatments as compared to weedy check.

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