



Yield performance and nutrient uptake as influenced by integrated weed management in clusterbean

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Clusterbean commonly known as 'Guar' is an important drought hardy leguminous crop which is cultivated mostly in the arid and semi-arid regions of tropical India. This crop is mainly cultivated in the marginal and rainfed areas where inadequate weed management is a major constraint in harnessing its production potential. Being a rainy season crop, it suffers badly due to severe competition by mixed weed flora. Yield reduction due to weed infestation to the tune of 53.7% has been observed (Saxena *et al.* 2004). Although weeds pose problems during entire crop growth period, initial one month of the crop is especially critical. Therefore, weed control needs to be ensured to exploit the yield potential of this crop. Hand weeding is a traditional and effective method but untimely rains, unavailability of labour at peak time and increasing labour cost are the main limitations. Under such situations, the only alternative that needs to be explored is the use of suitable herbicides which may be effective and economical.

A field experiment was conducted on clusterbean during *Kharif*, 2013 at the Instructional Farm, Agricultural Research Station, S.K. Rajasthan Agricultural University, Bikaner. The soil of the experimental field was loamy-sand in texture, alkaline in reaction (pH 8.22), low in organic C (0.08%), available N (78 kg), available P (22 kg) but medium in K (210 kg/ha). Sixteen treatments, *viz.* weedy check, weed-free, pendimethalin 0.75 kg/ha PE, pendimethalin 0.75 kg/ha + hand weeding at 30 DAS, imazethapyr 40 g/ha (25 DAS), imazethapyr 50 g/ha (25 DAS), imazethapyr 60 g/ha (25 DAS), imazethapyr 40 g/ha (25 DAS) + hand weeding at 40 DAS, imazethapyr 50 g/ha (25 DAS) + hand weeding at 40 DAS, imazethapyr 60 g/ha (25 DAS) + hand weeding at 40 DAS, imazethapyr + imazamox 40 g/ha (25 DAS), imazethapyr + imazamox 60 g/ha (25 DAS), imazethapyr + imazamox 80 g/ha (25 DAS), imazethapyr + imazamox 40 g/ha (25 DAS) + hand

weeding at 40 DAS, imazethapyr + imazamox 60 g/ha (25 DAS) + hand weeding at 40 DAS and imazethapyr + imazamox 80 g/ha (25 DAS) + hand weeding at 40 DAS were laid out in randomized block design with three replications. Recommended dose of 20 kg N and 40 kg P₂O₅/ha was applied to the crop. Pendimethalin as pre-emergence, imazethapyr and imazethapyr + imazamox as post-emergence were applied as per treatment. Weed-free treatment was achieved by repeated hand weeding. Randomly five plants were selected from each plot and biometric observations of crop and weed parameters were recorded at periodic intervals. Weed density and dry weight were recorded with a quadrat of 0.25 m². Weed control efficiency and weed index were calculated by standard formulae. Economic analysis was done as per the prevailing market price of different outputs and inputs.

Weed density and dry weight

The experimental field was heavily infested with mixed flora of broad-leaved and grassy weeds, *viz.* *Amaranthus spinosus* L., *Euphorbia hirta* L., *Aristida depressa* L., *Portulaca oleracea* L., *Digera arvensis* Forsk., *Gisekia poiedious*, *Cenchrus biflorus* L., *Tribulus terrestris* L., *Aervato mentosa* Forsk., *Corchorus tridense* L., *Eleusine verticillata* L., *Eragrostis tennela* and *Trianthema portulacastrum* L.

All the treatments resulted in significant reduction in weed density and dry weight of weeds over weedy check (Table 1). Weed-free treatment resulted in the lowest weed density and dry weight of weeds. However, imazethapyr at 60 g/ha at 25 DAS as post-emergence in combination with hand weeding recorded significantly least number of weeds (1.47/m²) and dry weight (1.78 g/m²) than any other treatment except weed-free. This might be due to control of weeds during early growth stage by application of imazethapyr at 25 DAS and later by hand weeding at 40 DAS. All weed control treatments significantly reduced the density as well as dry weight

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of weeds over weedy check. The reduction in dry weight of weeds due to pendimethalin 0.75 kg/ha as pre-emergence alone, pendimethalin 0.75 kg/ha as pre-emergence + one hand weeding at 30 DAS, imazethapyr 60 g/ha (25 DAS) + one hand weeding at 40 DAS and imazethapyr + imazamox 80 g/ha (25 DAS) + one hand weeding at 40 DAS was 95.7, 94.7, 98.1 and 94.7% compared to weedy check, respectively.

Effect on crop

Weed-free treatment recorded the highest dry matter production, pods/plant, seeds/pod, seed and straw yield, which were at par with pendimethalin 0.75 kg/ha, imazethapyr 40, 50, 60 g/ha and imazethapyr + imazamox 40, 60, 80 g/ha (Table 1). All herbicides integrated with hand weeding were significantly superior to weedy check. This might be due to minimizing the competition of weeds with main crop for resources, viz. space, light, nutrients and moisture with adoption of effective weed control methods. Thus, reduced crop-weed competition resulted in overall improvement in crop growth as reflected by increase in plant height and dry matter accumulation. The results corroborate with the findings of Singh *et al.* (1994) and Yadav *et al.* (2014). The lowest values of growth and yield attributes and yield were recorded in weedy check. Increase in seed yield might be due to the direct influence of various weed management treatments on the suppression of weeds. Thus, crop-weed

competition resulted in increased plant height, dry matter accumulation and nutrient uptake by crop. The results corroborate with the findings of Tiwari *et al.* (2014).

All weed management practices significantly enhanced seed yield over weedy check. There was no significant difference between seed yield with all the treatments except weedy check. Weed-free treatment produced the highest seed yield (1.49 t/ha), followed by pendimethalin 0.75 kg/ha + hand weeding 30 DAS (1.45 t/ha), while it was minimum under weedy check (0.77 t/ha).

Economics

Maximum net returns of ` 54,608 /ha were obtained with weed-free treatment, followed by ` 53,277/ha with pendimethalin 0.75 kg/ha alone. Benefit: cost ratio was highest with pendimethalin 0.75 kg/ha alone (3.88), followed by weed-free treatment (3.81).

Nutrient uptake by weeds and crop

All weed control treatments recorded significant increase in N, P and K uptake by the crop compared to weedy check (Table 2). The highest nutrient uptake was obtained with weed-free treatment, which was statistically at par with all other treatments except weedy check. Uptake of N, P and K by weeds followed the trend of weed biomass. It was found that all weed control treatments significantly reduced N, P and K uptake by weeds at harvest. The lowest total

Table 1. Effect of weed control measures on weed growth at harvest, and performance of clusterbean

Treatment	Weed density (no/m ²)	Weed dry weight (g/m ²)	Plant height at maturity (cm)	Pods/plant	Seed yield (t/ha)	Straw yield (t/ha)	Net returns (x10 ³ `/ha)	B:C ratio
Pendimethalin 0.75 kg/ha PE	2.49(5.7)	3.95	112.5	38.0	1.44	3.97	53.28	3.88
Pendimethalin 0.75 kg/ha PE + HW 30 DAS	2.29(4.7)	4.90	112.7	38.7	1.45	4.07	52.35	3.64
Imazethapyr 40 g/ha 25 DAS	4.72(21.7)	17.51	85.1	36.7	1.32	3.60	47.23	3.56
Imazethapyr 50 g/ha 25 DAS	4.54(20.1)	16.72	85.6	38.7	1.33	3.76	47.89	3.59
Imazethapyr 60 g/ha 25 DAS	4.43(19.2)	16.62	86.0	38.8	1.33	3.74	48.05	3.60
Imazethapyr 40 g/ha 25 DAS + HW 40 DAS	1.88(3.05)	2.71	86.6	39.5	1.37	3.79	48.41	3.44
Imazethapyr 50 g/ha 25 DAS + HW 40 DAS	1.66(2.3)	2.18	87.1	39.8	1.38	3.75	48.82	3.47
Imazethapyr 60 g/ha 25 DAS + HW 40 DAS	1.47(1.7)	1.78	87.5	39.1	1.39	3.81	49.29	3.49
Imazethapyr + imazamox 40 g/ha 25 DAS	2.49(5.7)	6.80	93.4	39.4	1.35	3.79	48.99	3.65
Imazethapyr + imazamox 60 g/ha 25 DAS	2.46(5.5)	6.84	93.9	40.0	1.36	3.70	48.99	3.65
Imazethapyr + imazamox 80 g/ha 25 DAS	2.44(5.4)	7.22	94.4	38.7	1.36	3.77	49.24	3.67
Imazethapyr + imazamox 40 g/ha 25 DAS + HW 40 DAS	2.17(4.2)	5.97	93.8	39.1	1.40	3.81	49.96	3.52
Imazethapyr + imazamox 60 g/ha 25 DAS + HW 40 DAS	1.99(3.4)	5.39	94.3	40.0	1.41	3.93	50.44	3.55
Imazethapyr + imazamox 80 g/ha 25 DAS + HW 40 DAS	1.78(2.6)	4.85	94.9	39.0	1.42	3.91	50.76	3.56
Weedy check	10.46(108)	91.94	71.3	28.7	0.77	2.18	21.53	2.28
Weed-free	0.71(0.0)	0.00	115.0	40.2	1.49	4.14	54.61	3.81
LSD (P=0.05)	1.22	5.13	18.67	5.30	0.28	0.65	12.72	0.66

Original figures in parentheses were subjected to square root transformation

Table 2. Effect of weed control measures on gum content, and nutrient uptake (kg/ha) by weeds and clusterbean

Treatment	Gum concentration (%)	Clusterbean			Weeds		
		N	P	K	N	P	K
Pendimethalin 0.75 kg/ha PE	28.6	84.2	16.9	65.5	7.71	1.04	5.19
Pendimethalin 0.75 kg/ha PE + HW 30 DAS	28.6	85.8	17.6	66.5	9.56	1.28	6.52
Imazethapyr 40 g/ha 25 DAS	28.1	71.4	14.7	54.8	34.03	4.48	23.43
Imazethapyr 50 g/ha 25 DAS	28.2	73.1	15.2	56.3	32.51	4.28	22.40
Imazethapyr 60 g/ha 25 DAS	28.3	73.1	15.2	56.2	32.29	4.25	22.17
Imazethapyr 40 g/ha 25 DAS + HW 40 DAS	28.4	76.7	15.9	58.9	5.41	0.74	3.90
Imazethapyr 50 g/ha 25 DAS + HW 40 DAS	28.5	77.4	15.9	59.3	4.39	0.61	3.24
Imazethapyr 60 g/ha 25 DAS + HW 40 DAS	28.0	78.1	16.1	59.9	3.61	0.51	2.73
Imazethapyr + imazamox 40 g/ha 25 DAS	28.3	78.4	16.2	60.2	13.47	1.80	9.95
Imazethapyr + imazamox 60 g/ha 25 DAS	28.4	78.2	16.1	60.0	13.55	1.81	10.02
Imazethapyr + imazamox 80 g/ha 25 DAS	28.5	78.8	16.3	60.5	14.31	1.91	10.62
Imazethapyr + imazamox 40 g/ha 25 DAS + HW 40 DAS	28.4	81.7	16.8	62.8	11.94	1.60	9.13
Imazethapyr + imazamox 60 g/ha 25 DAS + HW 40 DAS	28.5	83.4	17.2	64.0	10.81	1.46	8.39
Imazethapyr + imazamox 80 g/ha 25 DAS + HW 40 DAS	28.6	83.6	17.2	64.1	9.78	1.32	7.74
Weedy check	27.6	41.3	8.6	31.8	180.9	23.74	133.4
Weed-free	28.9	88.2	17.9	70.8	0.00	0.00	0.00
LSD (P=0.05)	NS	7.2	1.8	5.6	7.00	0.92	6.07

uptake by weeds was recorded with weed-free, which was at par with rest of the weed control treatments except imazethapyr 40, 50, 60 g/ha. Reduced nutrient uptake by weeds under the influence of different weed control measures was also reported by Gaikwad and Pawar (2003) and Chhodavadia *et al.* (2013). Gum concentration was not influenced by the weed control treatments.

It was concluded that all weed control treatments were equally effective in controlling weeds and improving crop yield of clusterbean. Weed-free recorded maximum yield and net profit, while the highest B:C ratio was achieved with pre-emergence application of pendimethalin 0.75 kg/ha. Post-emergence application of imazethapyr + imazamox 80 g/ha+ hand weeding at 40 DAS was the next best choice for controlling weeds in clusterbean.

SUMMARY

A field experiment was conducted to study the effect of integrated weed management practices on growth, yield, quality of clusterbean and nutrient uptake by crop and weeds at Bikaner during *Kharif* 2013. Higher yield were recorded under weed-free treatment. Weed biomass was reduced significantly by pendimethalin 0.75 kg/ha as pre-emergence as well as imazethapyr and imazethapyr + imazamox as post-emergence. The highest total uptake of N (88.2 kg), P (17.9 kg) and K (70.8 kg/ha) by the crop was recorded under weed-free conditions.

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