Legume Research. 38 (3) 2015: 415-418
Print ISSN:0250-5371 / Online ISSN:0976-0571

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com/www.legumeresearch.in

Weed control efficiency of post emergence herbicides and their effect on productivity of cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.]

A.S. Godara and Ravindra Singh*

Adaptive Trial Centre, Tabiji,
Ajmer-305 206, India.

Received: 03-05-2014 Accepted: 30-04-2015 DOI: 10.5958/0976-0571.2015.00126.5

ABSTRACT

A field experiment was undertaken to evaluate the performance of different weed control treatments in cluster bean during *kharif,* 2011 at Tabiji, Ajmer in randomized block design with three replications. Treatment of weed free check was found best by recording highest values of yield attributes, seed (12.20 q/ha), haulm (32.16 q/ha) and biological yield (44.36 q/ ha) with maximum weed control efficiency at successive stages. It was at par with Pendimethalin 1.0 kg/ha (PRE) + one hand weeding, imazethapyr 40 g/ha and imazethapyr 60 g/ha at 20 days after sowing (DAS). Among different herbicides treatments, imazethapyr 60 g at 20 DAS showed highest values of yield attributes, seed yield (11.65 q/ ha), haulm yield (31.12 q/ ha), weed control efficiency (90.1, 88.0 and 83.9 per cent at 30, 60 DAS and at harvest, respectively) and minimum weed index (4.7). In monetary term also imazethapyr 60 g/ha recorded higher net returns (Rs 69030/ha) and benefit-cost ratio (5.31) than season long weed free check (Rs 66990/ ha and 4.05, respectively) on account of higher cost of cultivation involved in latter treatment to a tune of Rs 5930/ ha.

Key words: Cluster bean, Post emergence herbicide, Weed control efficiency, Weed dry biomass, Weed Index.

Cluster bean (*Cyamopsis tetragonoloba*), vernacularly known as 'Guar', is a drought hardy leguminous, rainy season crop of semi-arid and arid regions of India. Presence of 30-35 per cent galactomann (gum) in its endosperm has changed it from a conventional crop to industrial crop. India ranks at top position in the world trade for guar gum and earns lot of foreign exchange by its export. Rajasthan ranks first in both area (33.2 lakh ha) and production (12.6 lakh tones) of cluster bean which constitutes 80.5 and 78.2 per cent of total area and production in the country, respectively.

However, cluster bean has rather low productivity of 380 kg/ ha on account of variety of production constraints; but being a rainfed crop, severe weed infestation leading to competition for different growth resources mainly water is a major constraint in achieving sustained higher productivity of cluster bean. Saxena *et al.* (2004) observed 53.7 per cent reduction in guar yield due to weed infestation. Among different weed management practices, hand weeding is traditional and effective option but unavailability of labor at peak weeding periods and increasing labor cost impose major limitations on economical feasibility of manual weeding. Pre-emergence application of pendimethalin and alachlor are only recommended herbicides in the region but if pre-emergence herbicide is skipped due to one or other reasons, no recommendation for post emergent herbicides is available. Further diversification in herbicide use is being increasingly desired for herbicide rotations to tackle the emerging cross and multiple resistances to herbicides in weeds. In this backdrop, present investigation was carried out to find out some suitable post emergence herbicide and optimize the application doses in cluster bean.

A field experiment was conducted during *Kharif*, 2011 at research farm of Adaptive Trial Centre, Tabiji, Ajmer, Rajasthan to evaluate pre-emergence and post-emergence herbicidal treatments in cluster bean. The treatments included -T_1: weedy check till maturity, T_2: weed free check, T_3: Pendimethalin 1.0 kg/ha at 0-3 days after sowing (DAS), T_4: Pendimethalin 1.0 kg/ha at 0-3 DAS+ one hand weeding at 30 DAS, T_5: Quizalofop-ethyl 25 g/ha at 20 DAS, T_6: Quizalofop-ethyl 37.5 g /ha at 20 DAS, T_7: Quizalofop-ethyl 50 g/ha at 20 DAS, T_8: Chlorimuron-ethyl 4 g/ha at 20 DAS, T_9: Chlorimuron-ethyl 6 g/ha at 20 DAS, T_{10}: Imazethapyr 20 g/ha at 20 DAS, T_{11}: Imazethapyr 40 g/ha at 20 DAS and

*Corresponding author e-mail and address: mahla_rs@yahoo.com.
*Address: NRC on Seed Spices, Tabiji, Ajmer 305 206 Rajasthan, India.

T_{12} : Imazethapyr 60 g/ha at 20 DAS. The experiment was laid out in randomized block design with three replications. The soil of experimental site was sandy loam in texture having 0.28 per cent organic carbon, low in available nitrogen (57.4 kg/ ha) and phosphorus (11.4 kg/ ha) but medium in available potassium (158.5 kg/ ha) status. Seeds of guar variety RGC-1003 were sown in rows at 30 cm on 1 August 2011. The recommended dose of fertilizers (15 kg N + 40 kg P_2O_5/ ha) was applied through urea and di-ammonium phosphate as basal dose through placement in furrows. Recommended package of practices were followed for successful cultivation of crop. Rainfall received during the crop period was 457.7 mm, which was almost well distributed.

Economic analysis was done on the basis of prevailing market prices of inputs and outputs. Sale price of guar seed was Rs 65000/ton; Input prices (per lit/ kg) were: urea Rs 5.80, DAP Rs 17.20; pendimethalin Rs 950, quizalofop-ethyl Rs 1630, chlorimuron-ethyl Rs 13267 and imazethapyr Rs 1720. Data on weed dry weight of weeds were recorded at 30, 60 DAS and at harvest using 50 x 50 cm quadrate. The weed flora emerged during the period of experimentation comprised of grasses mainly *Cyanadon dactylon* and *Echinochloa crus-galli; Sedges* like *Cyperus rotundus* and *Cyperus iria* and broad leaved weeds like *Amarathus viridis, Amaranthus spinosus* and *Commelina benghalensis.* Grasses and sedges especially *Cynadon dactylon* and *Cyperus rotundus* emerged during the initial growth stages whereas broad leaved weeds especially *Amaranthus sp.* emerged at later stages which dominated all other weeds after that.

Results revealed that different weed control options significantly reduced the weed dry weight than un-weeded control at 30 and 60 DAS and at harvest except the effect of 25.0, 37.5 and 50.0 g/ha quizalofop-ethyl was indifferent to un-weeded control at harvest (Table 1). Weed free check recorded significantly higher reduction in weed dry weight at 30 DAS and at harvest than other treatments but variations were statistically at par with application of imazethapyr 40 or 60 g/ha at 20 DAS and pre-emergence application of pendimethalin 1 kg /ha + one manual weeding at 30 DAS.

Among different methods of weed control, next to weed free check, application of imazethapyr 60 g/ha at 20 DAS recorded the lowest weed dry weight at different growth stages that led to higher weed control efficiency (90.1, 88.0 and 83.9 %) at 30, 60 DAS and at harvest, respectively (Table 1). This

TABLE 1: Weed dry weight, weed control efficiency and weed index as influenced by different weed control treatments in cluster bean

Treatment*	Dry weight of weeds†(g/m^2)			Weed control efficiency (%)			Weed index
	30 DAS	60 DAS	At harvest	30DAS	60DAS	At harvest	
T_1	4.3 (18.2)	6.4 (40.8)	12.6 (158.1)	0.0	0.0	0.0	100.0
T_2	0.7 (0.0)	0.7 (0.0)	3.8 (14.0)	100.0	100.0	91.1	0.0
T_3	2.4 (5.2)	3.6 (12.3)	7.0 (48.9)	71.4	69.9	69.1	37.2
T_4	2.3 (4.9)	2.6 (6.1)	5.3 (27.2)	73.1	88.1	82.8	5.0
T_5	3.3 (10.1)	4.9 (23.5)	10.9 (117.5)	44.5	42.4	25.7	88.0
T_6	3.2 (9.9)	4.8 (22.9)	10.4 (108.0)	45.6	44.1	31.7	66.4
T_7	3.1 (9.3)	4.9 (23.9)	10.4 (106.8)	49.5	41.4	32.5	96.1
T_8	2.6 (6.2)	4.0 (15.7)	8.7 (74.8)	65.9	61.8	52.7	38.6
T_9	2.5 (6.0)	3.8 (14.2)	7.6 (57.3)	67.6	65.2	63.7	23.4
T_{10}	1.7 (2.3)	3.1 (9.3)	6.9 (47.6)	87.4	76.2	69.9	21.8
T_{11}	1.6 (2.1)	2.6 (6.5)	5.5 (29.2)	88.5	84.3	81.5	5.4
T_{12}	1.5 (1.8)	2.3 (4.9)	5.2 (25.5)	90.1	88.0	83.9	4.7
CD (P=0.05)	0.9	1.2	2.5				

†Original figures in parenthesis were subjected to square-root (“X+0.5) before statistical analysis;
*Details of treatments are mentioned in the text

treatment was closely followed by imazethapyr 40 g /ha at 20 DAS and pre-emergence application of pendimethalin 1 kg /ha + one hand weeding. The highest weed control efficiency (90.10%) and lowest weed index (4.72%) of imazethapyr 60 g /ha reflected its selective nature and higher efficiency at this dose. Imazethapyr inhibits the plastid enzyme aceto-lactate syntheses (ALS) in plants. The ALS inhibitors stop cell division and reduce carbohydrate translocation in susceptible plants (Gupta, 2008). Imazethapyr controls a broad spectrum of weeds (Saltoni *et al.*, 2004). The results of this study are also supported by Rani *et al.* (2004), Dhaker *et al.* (2009) and Dhaker (2011).

Yield and yield attributing characters of cluster bean crop were greatly influenced by different treatments. The highest yield attributes, viz. pods/ plant (29.4), number of seeds/ pod (9.20), weight of seeds/ pod (0.33 g) and test weight (34.24 g) were recorded in weed free check but variations in pods/ plant and seeds/ pod were statistically at par with pendimethalin 1 kg / ha + one manual weeding as well as imazethapyr 40 or 60 g / ha. Use of imazethapyr 60 g/ha also recorded statistically at par variations in weight of seeds/ pod and test weight with weed free check. It is notable that lower weed dry weight and higher weed control efficiency i.e. lower crop-weed interface for sharing growth resources appeared to be a key factor in governing performance of yield and yield attributes of cluster bean crop. Among different weed control options, weed free check recorded the highest seed, haulm and biological yield as well as harvest index but these were statistically at par with imazethapyr 40 or 60 g /ha at 20 DAS and pre-emergence use of pendimethalin 1 kg /ha + one hand weeding (Table 2) revealing that these weed control options were equally effective as season long weed free check so far as productivity of cluster bean in Rajasthan is concerned.

Among the different weed control treatments, imazethapyr 40 g/ha registered the highest benefit-cost ratio (5.39) while highest net returns (Rs 69030) were obtained from imazethapyr 60 g/ha (Table 2). This may be attributed to higher weed control efficiency, least labor requirement and higher grain and haulm yield under imazethapyr. The comparatively lower net returns and benefit cost ratio in weed free check may be ascribed due to more labor cost.

Thus, imazethapyr by virtue of higher weed control efficiency or wide spectrum of weed control (both grassy and broad leaf weeds) throughout the crop season without causing any crop phytotoxicity emerged as a technically sound and economically viable option of post emergence weed control in cluster bean in this study. This has also been demonstrated by Kumar *et al.* (2003), Singh *et al.* (2011), Parvender *et al*. (2006), Shete *et al*. (2008), Vyas and Kushwah (2008) and Dhaker (2011).

The present study thus, concludes that post emergent application of imazethapyr 60 g/ha at 20 DAS, can be an effective weed control option in cluster bean crop with higher grain and stover yield and net returns under rainfed agro-ecosystem in semi arid and arid regions of Rajasthan.

TABLE 2: Yield attributes, yield and economics of cluster bean as influenced by different weed control treatments in cluster bean

Treatment*	Pods / plant	Number of seeds /pod	Weight of seeds /pod (g)	Test weight (g)	Seed yield (q/ha)	Haulm yield (q/ha)	Biological yield (q/ha)	Harvest index (%)	Cost of cultivation ($x10^3$ Rs/ha)	Net return ($x10^3$ Rs/ha)	Benefit-cost ratio
T_1	13.20	5.70	0.15	26.12	5.83	19.45	25.28	23.06	14.76	28.97	2.96
T_2	29.40	9.20	0.32	34.24	12.20	32.16	44.36	27.50	21.96	66.99	4.05
T_3	19.80	7.40	0.22	29.31	8.89	25.86	34.75	25.58	18.14	47.40	3.61
T_4	26.40	8.90	0.28	31.27	11.62	31.38	43.00	27.02	21.74	63.20	3.91
T_5	16.00	7.00	0.19	27.86	6.49	19.49	25.98	24.98	15.82	32.21	3.04
T_6	18.20	7.80	0.23	29.12	7.33	21.12	28.45	25.76	16.22	37.76	3.33
T_7	15.40	6.60	0.18	27.15	6.22	20.75	24.97	24.91	16.63	30.03	2.81
T_8	19.20	8.00	0.24	29.81	8.80	25.18	33.98	25.89	15.21	49.54	4.26
T_9	21.80	8.40	0.26	30.24	9.89	28.12	38.01	26.02	15.32	57.40	4.75
T_{10}	24.20	8.70	0.27	31.00	10.02	28.45	38.47	26.05	15.34	58.33	4.80
T_{11}	26.20	8.80	0.28	31.22	11.58	30.88	42.46	27.28	15.69	68.84	5.39
T_{12}	27.00	9.00	0.30	33.45	11.65	31.12	42.77	27.24	16.03	69.03	5.31
CD(P=0.05)	4.26	0.78	0.03	2.14	1.54	2.32	2.94	2.78			

*Details of treatments are mentioned in the text

REFERENCES

Dhaker, H., Mundra, S.L. and Jain, N.K. (2009). Weed management in clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.]. *Indian J. Weed Sci.,* **41**:224-227.

Dhaker, S. (2011). Effect of weed management and sulphur nutrition on productivity of soybean [*Glycine max* (L.) Merill].M.Sc.(Ag.) Thesis, Deptt. of Agronomy, MPUAT, Udaipur.

Gupta, O.P. (2008). Functional features of some currently used herbicides. Modern Weed Management 3rd Revised Edition, AGROBIOS (INDIA), Jodhpur pp.223.

Kumar, V., Singh, S. and Gill, O.P. (2003). Integrated weed management in irrigated groundnut (*Arachis hypogaea* L.). *Indian J. Agronomy,* **48**:117-119.

Parvender, S., Singh, S. and Sardana,V. (2006). Effect of weed management practices on yield and economics of mungbean in kandi region of Punjab. *Indian J. Pulse Res.,* **19**:263-234.

Rani, B.P., Ramana, M.V. and Reddy, M.V. (2004). Evaluation of different post emergence herbicides in soybean, *Glycine max* (L.) in vertisols of Andhra Pradesh. *J. Oilseeds Res.,* **21**:293-295.

Saltoni, N. Shropshire, C., Cowan, T. and Sikkema, P. (2004). Tolerance of black beans (*Phaseolus vulgaris*) to soil application of S-metalochlor and imazethapyr. *Weed Technol.,* **18**:111-118.

Saxena, A., Singh, Y.V. and Singh, R. (2004). Crop weeds competition in cluster bean in arid region. *J. Arid Legumes,* **1**:41-43.

Shete, B.T., Patil, H.M. and Ilhe, S.S. (2008). Effect of cultural practices and post emergence herbicides against weed control in soybean. *J. Maharastra Agricl. Uni.,* **33**:118-119.

Singh, W., Singh, R., Malik, R. P. and Mehta, R. (2011). Effect of planting density and weed management options on weed dry weight and cane yield of spaced transplanted sugarcane (*Saccharum officinarum* L.) after wheat harvest in sub tropical India. *Indian J. of Weed Sciences,* **43**: 97-100.

Vyas, M.D. and Kushwah, S.S. (2008). Effect of cultural and chemical methods on growth and yield of soybean in Vindhynagar plateau of Madhya Pradesh. *Indian J. Weed Sci.,* **40**:92-94.