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Effect of post-emergence herbicides on weed control, growth and yield of cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] in M.P.

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ABSTRACT

A field experiment was undertaken to evaluate the performance of different weed control treatments in cluster bean during *kharif,* 2015 in RBD with three replications. Treatment of weed free check was found best by recording highest values of yield attributes, seed (20.97 q/ha), stover (65.68q/ha) with maximum weed control efficiency at successive stages. Among different herbicides treatments, Imazethapyr + Imazamox @ 40 g/ha (PoE) at 20 DAS showed highest values of yield attributes, seed yield (19.59 q/ ha), stover yield (63.83 q/ ha), WCE (91.84, at 60 DAS) and minimum WI (6.0). In monetary terms significantly highest net return (Rs.86883 /ha) were obtained from weed free check, followed by imazethapyr + imazamox @ 40 g/ha (PoE) at 20 DAS (Rs.85398 / ha) and imazethapyr @ 75 g/ha (PoE), at 20 DAS (84394 Rs./ha). The maximum B:C ratio of 6.57 was recorded with treatment imazethapyr @ 75 g/ha (PoE), followed by imazethapyr+ imazamox @ 40 g/ha (PoE) 6.37.

Key words: Cluster bean, Cycloxydim, Imazethapyr + Imazamox, Imazethapyr, Post emergence herbicide.

Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.] commonly known as 'Guar', is an important drought hardy leguminous crop. It is mostly cultivated in arid and semiarid regions of tropical India during *kharif* season. Presence of 30-35 per cent galactomann (gum) in its endosperm has changed it from a conventional crop to industrial crop. In India, the total cultivated area under clusterbean is 4.25 million hectare with a production of 2.42 million tonnes and with a productivity of 567 kg/ha. (Ministry of Agriculture, GOI, 2014-15). In Madhya Pradesh cultivated area under clusterbean as pure crop is 70622 ha with a productivity of 705 kg/ha (CLRS 2013).

Being a rainy season crop, it suffers badly due to severe competition by mixed weed flora. Saxena *et al*. (2004) observed 53.7% reduction in guar yield due to weed infestation. Season long competition with weeds in clusterbean causes severe yield reduction ranging from 29-48 per cent and severity may even be higher (70-98%) depending on the weed infestation. Reports indicate that in the absence of any other inputs, weed control alone is responsible to increase the seed yield by 61 per cent (Yadav *et al.*, 1991).

In the last four decades, considerable development have been made in chemical weed control. Adoption of chemical weed control is increasing crop return by reducing the cost of production.

A field experiment was conducted under AICRP on Arid legumes at the Research Farm, College of Agriculture, Gwalior during *kharif* season of 2015. The experiment was laid out in randomized block design with 3 replications. There were 12 treatments, *viz*. T_1: Cycloxydim @ 75 g a.i./ha (PoE) at 20 DAS, T_2: Cycloxydim @ 100 g a.i./ha (PoE) at 20 DAS, T_3: Cycloxydim @ 125 g a.i./ha (PoE) at 20 DAS, T_4: Cycloxydim @ 75 g a.i./ha + MSO Adjuvent @2ml/l of water at 20 DAS, T_5: Cycloxydim at 100 g a.i./ha + MSO Adjuvent @2ml/l of water

At 20 DAS,T_6: Cycloxydim at 125 g a.i./ha + MSO Adjuvent @2ml/l of water at 20 DAS,T_7: Quizalofop-p-ethyl @ 37.5 g a.i./ha (PoE) at 20 DAS,T_8: Fenoxaprop-p-ethyl @ 100 g a.i./ha (PoE) at 20 DAS,T_9: Imazethapyr + Imazamox @ 40 g a.i./ha (PoE) at 20 DAS ,T_{10}: Imazethapyr @ 75g a.i./ha (PoE) at 20 DAS, T_{11}: Weed free check and T_{12}: Weedy check. The recommended dose of N, P_2O_5 and K_2O were applied @ 20, 40 and 20 kg/ha, respectively. Nitrogen, phosphorus and potassium were applied through urea, single super phosphate (SSP) and muriate of potash (MOP), respectively. All the fertilizers doses were applied as basal dose at the time of sowing. Variety of clusterbean 'HG 563' was used in this experiment. Prior to sowing, the field was well laid out and prepared as per the standard procedure.

The data pertaining to weed population recorded at 20, 40, 60 DAS and harvest were subjected to Log (X+1)

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and $\sqrt{x + 0.5}$ transformations as per requirement for statistical analysis. Data were analyzed as per standard procedure with 5% probability level.

The weed flora emerged during the experimentation comprised mainly broad leaf weeds *viz., Digera arvensis, Commelina benghalensis, Alternanthera sessilis* and *Trianthema monogyna.* Among narrow leaf weeds viz., *Cyperus rotundus, Dactyloctenium aegyptium, Eragrostis sp., and Leptochloa chinensis.* Weed count reduced drastically with the use of herbicides at 20 DAS. Lowest total (broad and narrow leaf) weed density was recorded in weed free check. Most effective control of broad leaf as well as narrow leaf weeds over other treatments by post-emergence application of herbicides imazethapyr + imazamox @ 40 g a.i./ha (PoE) at 20 DAS at 40, 60 DAS and harvest, followed by imazethapyr @ 75 g a.i./ha (PoE) at 20 DAS. Similar results were reported by Shete *et al.* (2008), Singh *et al.* (2011). Application of quizalofop @ 37.5 g a.i./ha (PoE) at 20 DAS reduced density and dry weight of monocot weeds. While fenoxaprop-p-ethyl @ 100 g a.i./ha (PoE) at 20 DAS and Cycloxydim @ 75 g a.i./ha + MSO Adjuvent @ 2ml/l of water at 20 DAS were found effective in suppressing narrow leaf weeds Cycloxydim showed maximum efficiency in the control of *Leptochloa chinensis, Digitaria ciliaris* (Crab grass). The superiority of quizalofop @ 37.5 g a.i./ha (PoE) at 20 DAS and fenoxaprop-p-ethyl @ 100 g a.i./ha (PoE) at 20 DAS in respect of controlling the weed especially narrow leaf was reported by Valaie *et al.* (2012) and Balyan *et al.* (1996).

Results revealed that different weed control options significantly reduced weed dry weight than weedy check or unweeeded. Weed free check recorded significantly higher reduction in weed dry weight at 20, 40, 60 DAS and at harvest stage due to complete control of broad and narrow leaf weeds than other treatments but variations were statisticaly at par with application of imazethapyr + imazamox @ 40 g a.i./ha (PoE) at 20 DAS. Imazethapyr @ 75 g a.i./ha (PoE) at 20 DAS demonstrated a very effective mortality of broad and narrow leaf weeds resulting in decline in dry matter accumulation except *Eragrostis sp.* of weed and proved best of all the treatments for weed control. This may mainly be attributed to nil or least weed density per unit area recorded under the treatments. Similar results were also reported by Tomar *et al.* (1991), Dhaker (2009), Patil *et al.* (2013) and Godara (2015).

Highest weed biomass was found in T_{12} weedy check (49.83 q/ha) which was significantly higher over other treatments. However lowest weed biomass was recorded with T_9 imazethapyr + imazamox @ 40 g a.i./ha (PoE) at 20 DAS (4.9333 q/ha).

Highest weed control efficiency was recorded in weed free check (100%) which was followed by imazethapyr+ imazamox @ 40 g a.i./ha (PoE) at 20 DAS (91.84%) and imazethapyr @ 75 g a.i./ha (PoE) at 20 DAS (91.63%). The higher weed control efficiency under these treatments was reflected due to lower dry weight of weeds. Similar results were reported by Patil *et al.* (2013) in imazethapyr + imazamox @ 40 g a.i./ha (PoE) at 20 DAS.

Weed index is indirectly related to the reduction in yield due to weed population and weed dry weight. Weed free check and imazethapyr + imazamox @ 40 g a.i./ha (PoE)

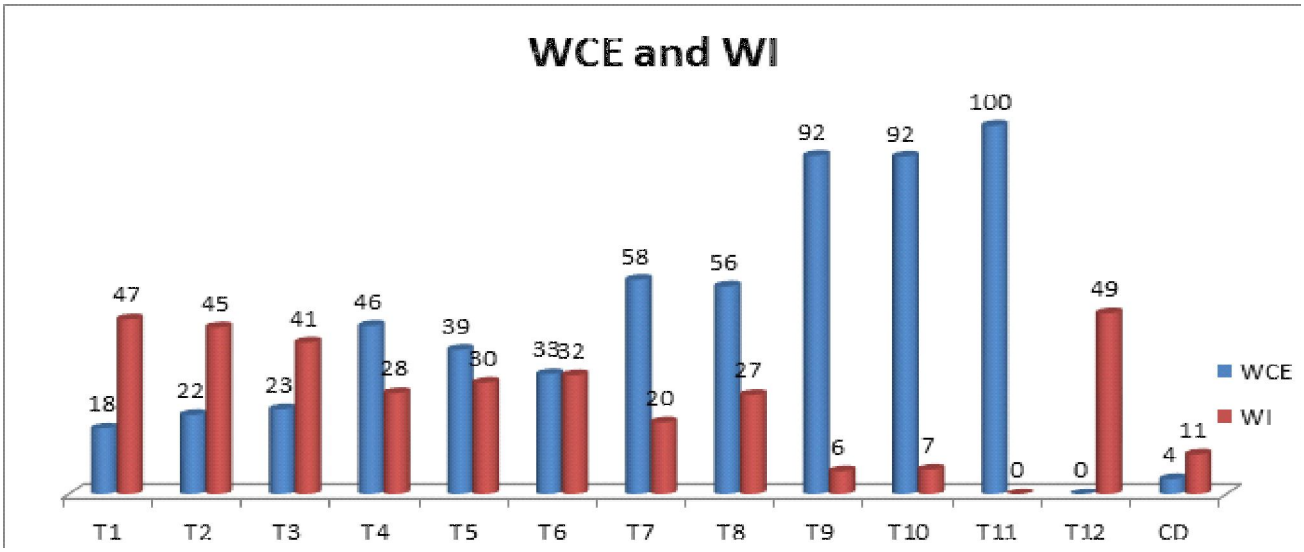

Fig 1: Effect of herbicides on weed control efficiency (%) at 60 DAS and Weed Index (%)

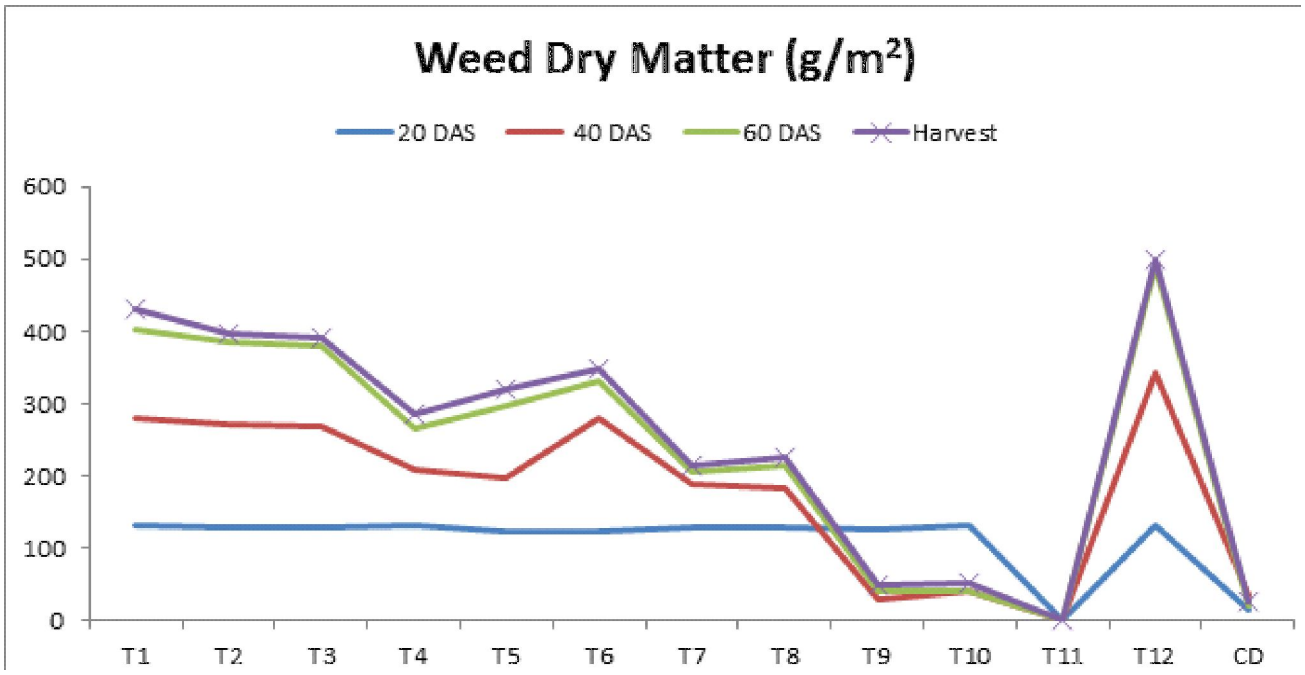

Fig 2: Effect of herbicide on dry matter of weed.

at 20 DAS recorded minimum weed index, which was followed by imazethapyr @ 75 g a.i./ha (PoE) at 20 DAS. The highest weed index was noted in weedy check due to non control of weeds as shown in Fig.1, Fig.2 and Table 1 regarding WCE and WIIS

All growth parameters (as shown in Table no. 2) *viz.,* plant height and number of branches plant were significantly influenced by weed control treatments at all crop growth stages except at 20 DAS in case of number of branches per plant. Combined application of imazethapyr + imazamox @ 40 g a.i./ha (PoE) at 20 DAS was found most effective herbicides to enhance the plant height and number of branches/plant and it was significantly superior over rest of treatments. However, imazethapyr @ 75 g a.i./ha (PoE) at 20 DAS, was significantly higher only over weedy check.

All the weed control treatments significantly increased dry weight/plant over weedy check. From weed free check highest dry weight was recorded which was significantly higher over all other treatments.

The highest number of pods/m^2, number of seeds per pod, test weight, seed and stover yield/plant were reported in weed free check Plate 1. The difference between imazethapyr + imazamox @ 40 g a.i./ha (PoE) at 20 DAS and imazethapyr @ 75 g a.i./ha (PoE) at 20 DAS, in respect of all yield attributing characters were at par with each other except some treatments of cycloxydim herbicide. These results also collaborate with the finding of Singh *et al.* (2011).

The highest seed and stover yield was recorded in weed free check, followed by imazethapyr + imazamox @ 40 g a.i./ha (PoE) at 20 DAS treatment which was at par with imazethapyr @ 75 g a.i./ha (PoE) at 20 DAS. Similar result has been reported by Prassana *et al.,* (2015) and Patil *et al.* (2013), Rawat *et al.*(2014).

The maximum gross income and net return of (Rs.108143/ha and Rs. 86883/ha) respectively, was obtained with Weed free check. The treatment, T_9 imazethapyr + imazamox @ 40 g a.i./ha (PoE) at 20 DAS, T_{10} (Plate 2.) (imazethapyr @ 75 g a.i./ha (PoE) and T_7 Quizalofop @ 37.5 g a.i./ha (PoE) at 20 DAS were next treatments in order of their higher efficiency.

On the basis of above findings, it may be concluded that significantly highest seed yield (20.97 q/ha) and net return (Rs.86883 /ha) were obtained from weed free check, followed by imazethapyr+ imazamox @ 40 g a.i./ha (PoE) at 20 DAS (19.59 q/ha, Rs.85398 /ha) and imazethapyr @ 75 g a.i./ha (PoE), at 20 DAS (19.25 q/ha, 84394 Rs./ha). And gave best result in all aspect. The maximum benefit cost ratio of 6.57 was recorded with treatment imazethapyr @ 75 g a.i./ha (PoE), followed by imazethapyr+ imazamox @ 40 g a.i./ha (PoE) 6.37.

Table- 1: Effect of weed control treatments on weed population, weed dry matter, weed biomass.

Treatments	Weed density at harvest (no./ sqm)			Weed dry weight at harvest		Weed Biomass at harvest (kg/ha)
	Broad leaf	Narrow leaf	Total weeds	Broad leaf	Narrow leaf	
T_1: Cycloxydim @ 75 g a.i./ha (PoE)	1.65 (44.00)	2.13 (27.67)	1.86 (71.67)	403	152	4317
T_2: Cycloxydim @ 100 g a.i./ha (PoE)	1.63 (42.00)	1.40 (27.00)	1.84 (69.00)	385	130	3957
T_3: Cycloxydim @ 125 g a.i./ha (PoE)	1.59 (37.67)	1.53 (32.67)	1.85 (69.33)	381	127	3903
T_4: Cycloxydim @ 75 g a.i./ha + MSO Adjuvent @2ml/l of water	1.61 (39.67)	1.49 (29.67)	1.85 (65.33)	266	82	2867
T_5: Cycloxydim at 100 g a.i./ha + MSO Adjuvent @2ml/l of water	1.56 (35.67)	1.49 (29.67)	1.82 (65.00)	298	92	3207
T_6: Cycloxydim at 125 g a.i./ha + MSO Adjuvent @2ml/l of water	1.59 (38.00)	1.40 (24.00)	1.80 (62.00)	331	105	3487
T_7: Quizalofop-p-ethyl @ 37.5 g a.i./ha (PoE)	1.58 (37.33)	1.18 (14.33)	1.72 (51.67)	205	34	2147
T_8: Fenoxaprop-p-ethyl @ 100 g a.i./ha (PoE)	1.57 (36.33)	1.25 (17.33)	1.74 (53.67)	214	38	2247
T_9: Imazethapyr + Imazamox @ 40 g a.i./ha (PoE)	0.88 (6.67)	1.16 (13.67)	1.37 (22.33)	40	35	493
T_{10}: Imazethapyr @ 75g a.i./ha (PoE)	1.12 (9.00)	1.24 (16.33)	1.47 (28.67)	41	34	513
T_{11}: Weed free check	0.00 (0.00)	0.00(0.00)	(0.00)	0	0	0
T_{12}: Weedy check	1.78 (60.67)	1.84(68.33)	2.11 (129.0)	490	206	4983
S.E.(m)±	**0.03**	**0.19**	**0.02**	**6.53**	**1.44**	**88.41**
C.D. (at 5%)	**0.09**	**0.55**	**0.06**	**19.24**	**4.23**	**260.57**
	Log x+1	**Log x+1**	**Log x+1**			

Figures in parentheses indicate original values, herbicides were applied 20 days after sowing (DAS).

Table-2: Effect of weed control treatments on growth, yield attributes, yield and economics of clusterbean.

Treatments	Plant height	Branches/ plant	DW/plant & (60 DAS)	DW/plant & (Harvest)	Pods/ plant	Seeds/ pod	100 seed weight (g)	Seed yield/ plant (g)	Stover yield/ plant (g)	Seed yield plant(g)	Stover yield(q/ha)	Harvest index (%)	Gross return (Rs./ha)	Net income (Rs./ha)	B:C Ratio
T_1	114	3.82	11	34	37	7.00	28.00	6.00	27.69	10.98	50.75	21.62	57438	41078	3.51
T_2	115	3.90	10	30	37	7.10	28.42	5.97	24.33	11.29	46.11	24.35	58806	41946	3.49
T_3	109	4.13	11	33	38	7.05	29.00	6.72	26.36	12.33	48.09	25.79	64054	46694	3.69
T_4	112	4.77	13	39	40	8.15	30.12	8.28	30.28	15.13	55.30	27.38	78415	61855	4.74
T_5	112	4.00	12	36	39	8.13	30.00	7.50	28.57	14.50	55.07	26.56	75254	58194	4.41
T_6	112	4.48	12	37	38	8.11	29.82	7.55	29.03	14.27	54.96	26.02	74098	56538	4.22
T_7	116	4.49	13	38	43	8.04	31.00	8.88	29.59	16.77	55.79	30.17	86640	70598	5.40
T_8	108	4.43	13	38	43	8.00	30.00	8.31	29.75	15.33	54.32	28.87	79366	63746	5.08
T_9	121	5.33	14	43	46	8.16	33.89	10.13	32.95	19.59	63.83	31.09	101308	85398	6.37
T_{10}	115	5.02	14	43	46	8.15	33.67	9.63	32.91	19.25	65.68	29.63	99534	84394	6.57
T_{11}	123	6.10	15	44	48	8.60	33.93	10.68	33.58	20.97	65.68	32.25	108143	86883	5.09
T_{12}	108	3.83	10	31	33	6.33	27.97	5.49	25.58	10.58	49.32	21.70	55383	41123	3.88
S.E.(m)±	**2**	**0.56**	**0.60**	**1.16**	**1.95**	**0.58**	**1.21**	**0.70**	**2.82**	**1.1284**	**4.2654**	**1.84**			
C.D.(at 5%)	**7**	**1.64**	**1.76**	**3.43**	**5.74**	**1.71**	**3.57**	**2.06**	**8.32**	**3.3255**	**1.25711**	**5.41**			

*: Details of treatments are mentioned in the text.



Plate-1: Weed Free Check



Plate-2: Imazethapyr @ 75 g a.i./ha at 20 DAS (PoE)

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