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Short Communication

Effect of herbicides on weed control efficiency and yield of cluster bean (*Cyamopsis tetragonaloba*)

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Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] is drought hardy deep rooted annual legume and considered as one of the most drought tolerant grain legumes in India. In India, the crop is grown for fresh vegetable and for gum purpose. The crop is mainly grown in the dry habitats of Rajasthan, Haryana, Gujarat and Punjab and to a limited extent in Uttar Pradesh and Madhya Pradesh. In India the total area under Cluster bean is 23.30 lakh ha with a production of 11.98 lakh tons green pod and a productivity of 428.0 kg ha^{-1}. The maximum contribution in respect of area is shared by Rajasthan (18.18 lakh ha), followed by Gujarat (2.27 lakh ha), Haryana (1.27 lakh ha) and Punjab (0.14 lakh ha) with a production of 19.85 lakh tons, 2.27 lakh tons, 1.20 lakh tons and 0.14 lakh tons, respectively. Rajasthan alone contributes about 78% area and 81 per cent production to the national basket of Guar. As a guar is a rainy season crop and due to frequent rains the weed growth tremendous which competes for nutrients, moisture and space with main crop causing considerable yield reduction (Dauay and Singh 1982). Season long competition with weeds in Cluster bean causes severe yield reduction ranging from 29-48 per cent and severity may even be higher (70-98%) depending on the weed infestation (Sonone et. al. 1982). Reports indicate that in the absence of any other inputs, weed control alone is responsible to increase the seed yield by 68 per cent (Yadav et. al. 1993) at Bawal and 61 per cent (Yadav et.al. 1991) at Hisar. The predominant weed flora that inhibits the growth and yield of the crop vary with soil type, moisture condition and other climatic factors. In most of the vegetables, the early growth period is the most critical stage at which stress of any kind affects the economic yield. Weed competition is an important stress during this period. This growth period is often marked by weather conditions that do not permit the traditional methods of weed control. Besides, this period coinciding with the season of peak labour activity leading to scarcity of labour for weeding. All this add to high cost of production. Keeping in view of this, the present study was carried out.

The present investigation was carried out during *kharif* season of 2016 at All India Coordinated Research Project on Vegetable Crops, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri. The soil of experimental plot was light to medium black having pH 6.5 to 7.5 and low in available nitrogen, medium in phophorus and ample in potash content. Tentreatments comprising T_1-Cycloxydim 200 g/l EC, 75g a.i./ha; T_2-Cycloxydim 200 g/l EC, 100g a.i./ha; T_3-Cycloxydim 200 g/l EC, 125g a.i./ha; T_4-Cycloxydim 200 g/l EC, 75g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright); T_5- Cycloxydim 200 g/l EC, 100g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright); T_6-Cycloxydim 200 g/l EC, 125g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright); T_7-Quizalofop-ethyl 5% EC,37.5 g a.i./ha; T_8-Fenoxaprop ethyl 9% EC,100 g a.i./ha; T_9-Weed Free Check and T_{10}-untreated control. The experiment was laid out in randomized block design and replicated thrice. The flat beds of 2.10x 2.40 m size were prepared and seeds of new released variety " phule Guar "was used and sowing was done at a spacing of 30x15 cm. The well decomposed FYM @ 20t/ha was applied uniformly at the time of land preparation. In addition, crop was fertilized with 50 kg N,60 kg P_2O_5 and 60 kg K_2O/ha. Half dose of N and full dose of P and K were applied at the time of seed sowing and remaining half dose of N was applied at 20-30 days after seed sowing. Light irrigation was given immediately after sowing and subsequent irrigations and plant protection measures were adopted as and when required. All herbicide spray were applied when the weeds were at two leaf stage. Herbicides were applied with a manually operated Knapsack sprayer with flat fan nozzle. The spray volume

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considered to be 500 liter/ha. The observations on weed population (intensity) was recorded at pre spray, 20 and 40 days after herbicidal spray by using 0.5 m quadrant in randomly selected places in each plot per replications. The weed control efficiency (WCE) was calculated by using following formula.

$$\% \text{ WCE} = \frac{\text{Weed count in untreated plot} - \text{Weed count in treated plot}}{\text{Weed count in untreated plot}} \times 100$$

The weed dry matter production (WDMP) was calculated by removing total weeds from 0.5m^2 treatment plot after 60 days and air dried ands kept in hot air oven at 60 ^{oC} for further drying. The green pod yield was recorded at each harvesting and sum up after completion of crop period and average pod yield per hectare was mentioned. The data on weed population, weed control efficiency, weed dry matter and green pod yield were recorded treatment wise and replication wise by following standard procedure. These data subjected to be analyzed as per standard method suggested by Panse and Sukhame (1989). Analysis of variance was performed for all measured traits to test the significance of variation among various herbicide treatments.

The important grass weeds observed in experimemtal plot were *Echinochloa colonum, Dinebra Arabica, Bracheria mutica* and *Eragratis minor* while common broad leave weeds were *Amaranthus viridis, Amaranthus polygamus, Euphorbia geniculata, Portulaca oleracea, Parthenium hysterophorus* and *Physelis minima.*In present study none of the herbicide were found effective in controlling *Cyprus rotundus, Cyanadon dactylo* and *Commelina bengalensis* among the weed flora present in experimental plot. The data presented in Table 1 revealed that only some herbicides were promising as compared to others. However, in unweeded control there was profuse growth of weeds throughout the growth period resulting in the suppressing growth and yield of cluster bean. At 20 and 40 days after application (DAA) all herbicidal treatments recorded lower weed count compared to unweeded control providing their effectiveness in combating the weed menace during their crop growth. In present study the T_6-Cycloxydim 200 g/l EC, 125g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright) found effective and recorded significantly minimum weed intensity of grasses at 20 days (15.1) and 40 days (13.0). But cycloxydim was not effective for controlling the broad leaf weeds in cluster bean crop. Because this, herbicide specially recommended for controlling grassy weeds. Similar reports have been reported by Sumanth Kumar (2005) and Bhadoria et al. (1996) in cluster bean.

The data on weed control efficiency (WCE) indicated significant differences due to various herbicides (Table 2). Among the various herbicide treatments, WCE was found to be significantly higher in T_6-Cycloxydim 200 g/l EC, 125g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright) at 20 days (64.64%) and 40 days (79.26%) respectively for grass weeds. However, T_8-Fenoxaprop ethyl 9% EC,100 g a.i./ha; registered highest WCE for broad leaf weeds at 20 days (60.3%) and T_7-Quizalofop-ethyl 5% EC,37.5 g a.i./ha at 40 days (48.5 %) . cycloxydim with and without MSO was not as effective as for controlling broad leaf weeds. These results are inconformity with those of Sumanth Kumar (2005).

The total dry matter of weeds as influenced by different herbicides at different concentrations and crop weed competition at different growth stages in cluster bean Table 2. In general weight of dry weed matter production was significantly higher in untreated control treatment (276.0 g/0.5m2 and 3.3012 kg/plot) followed by Fenoxyprop ethyl 9% EC (273.0 and 3.276 resp.) and Chlorimuron ethyl 25WP (180.7 and 2.168 resp.). The

Table 1: Effect of different herbicides on total weed intensity (population) per 0.5 m^2 in Cluster bean**.**

T.No.	Treatment	Grasses			Broad Leaf weeds (BLW)		
		Pre spray	20 DAA	40DAA	Pre spray	20 DAA	40DAA
T_1	Cycloxydim 200 g/l EC, 75g a.i./ha	36.7	29.0	29.0	19.7	11.2	13.8
T_2	Cycloxydim 200 g/l EC, 100g a.i./ha	36.3	27.0	25.0	13.0	13.0	10.4
T_3	Cycloxydim 200 g/l EC, 125g a.i./ha	29.0	22.0	16.3	11.0	11.9	9.7
T_4	Cycloxydim 200 g/l EC, 75g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright)	25.0	18.0	22.7	9.8	9.8	10.7
T_5	Cycloxydim 200 g/l EC, 100g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright)	18.0	15.3	21.7	11.4	11.4	10.4
T_6	Cycloxydim 200 g/l EC, 125g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright)	13.0	15.1	13.0	11.0	11.0	9.5
T_7	Quizalofop-ethyl 5% EC,37.5 g a.i./ha	27.3	23.6	32.7	6.0	6.7	6.7
T_8	Fenoxaprop ethyl 9% EC,100 g a.i./ha	44.7	43.7	34.7	4.7	4.7	7.3
T_9	Weed Free Check	-	-	-	-	-	-
T_{10}	Control	64.3	43.0	62.7	15.9	16.9	13.0
	S. E. $\pm$	7.0	5.61	7.09	3.43	3.39	1.60
	C.D. at 5%	20.8	16.67	21.0	10.20	10.07	4.75

DAA: Days after application

Table 2: Effect of different herbicide on per cent weed control efficiency (WCE) , weed dry matter and yield in cluster bean.

T. No.	Treatment	WCE of Grasses		WCE of BLW		Weed dry matter (g/ 0.5 m2)	Yield (q/ha)
		20 DAA	40 DAA	20 DAA	40 DAA		
T_1	Cycloxydim 200 g/l EC, 75g a.i./ha	32.5	53.74	16.5	13.8	206.0	35.41
T_2	Cycloxydim 200 g/l EC, 100g a.i./ha	37.21	60.12	23.1	20.0	201.3	35.81
T_3	Cycloxydim 200 g/l EC, 125g a.i./ha	48.83	74.0	29.5	25.0	180.7	50.71
T_4	Cycloxydim 200 g/l EC, 75g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright)	58.13	63.79	42.1	17.6	158.0	64.52
T_5	Cycloxydim 200 g/l EC, 100g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright)	64.41	65.39	32.5	20.0	150.0	73.68
T_6	Cycloxydim 200 g/l EC, 125g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright)	64.64	79.26	34.9	26.9	139.3	89.11
T_7	Quizalofop-ethyl 5% EC,37.5 g a.i./ha	45.11	47.84	60.3	48.5	180.7	50.38
T_8	Fenoxaprop ethyl 9% EC,100 g a.i./ha	-1.6	44.65	72.2	43.8	273.0	45.78
T_9	Weed Free Check	-	-	-	-	-	95.16
T_{10}	Control	-	-	-	-	276.0	35.20
	S. E. $\pm$	0.17	0.73	1.14	2.20	2.47	2.83
	C.D. at 5%	0.53	2.20	3.44	6.61	7.40	8.66

DAA: Days after application

lowest total dry weed matter was observed with T_6-Cycloxydim 200 g/l EC, 125g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright) . These findings are in concordance with those of Sumanth Kumar (2005) in cluster bean.

The data on cluster bean green pod yield indicated significant differences due to various herbicide treatment (Table 2). The green pod yield was significantly higher in weed free check (95.16 q/ha.) because of plot was free from weeds and therefore no competence for growth and which results in maximum yield however it increases the cost of production. The next best treatment in herbicide was T_6-Cycloxydim 200 g/l EC, 125g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright) which recorded the yield of 89.11 q/ha. Shekhawat and Maliwal (1991) reported that application of pendimethalin @ 0.75kg a.i./ha was effective in reducing weed dry matter and increased the yield significantly. On the basis of pod yield of cluster bean, weed population and weed control efficiency by application of at two leaf stage of weed as post emergence spray of herbicide i.e. T_6-Cycloxydim 200 g/l EC, 125g a.i./ha + MSO Adjuvant @ 2 ml/l of water (outright) was best alternative to hand weeding and found effective doses in controlling weeds and increasing green pod yield of cluster bean.

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