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Effect of weed management practices on the performance of clusterbean [*Cyamopsis tetragonoloba*(L.) Taub]

S.K. Brar

Punjab Agricultural University,
Regional Station, Bathinda-151 001, India.

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ABSTRACT

A field experiment was undertaken at PAU, Regional Station (Bathinda) to evaluate the effect of weed management practices on the performance of cluster bean [(*Cyamopsis tetragonoloba* (L.) Taub] under AICRP on Arid Legumes during the *kharif* season of 2015 and 2016. Data revealed that weed dry matter was lowest in case of weed free check (T_8) as plots were kept weed free as per the treatment. Among other treatment combinations Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr+ Imazamox @ 40g a.i./ha at 2-3 leaf stage of weeds (T_7) produced the lowest weed dry matter closely followed by Pendimethalin @ 0.75 kg a.i./ha as PE+ One Intercultivation at 20-25 DAS (T_6) and Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds (T_5). WCE was highest in weed free followed by Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr+ Imazamox @ 40g a.i./ha at 2-3 leaf stage of weeds (T_7). Highest seed yield was recorded in weed free check followed by Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds (T_5), Pendimethalin @ 0.75 kg a.i./ha + One Intercultivation at 20-25DAS (T_6) and Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr+ Imazamox @ 40g a.i./ha at 2-3 leaf stage of weeds (T_7)

Key words: Cluster bean, Post emergence herbicide, Weed control efficiency (WCE), Weed dry biomass.

INTRODUCTION

Cluster bean [*Cyamopsis tetragonaloba* (L.) Taub], a *kharif* pulse crop is considered as one of the most drought tolerant deep-rooted and annual legume in India. The crop is grown for fresh vegetable and for gum purpose. In India, 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 was 42.55 lakh ha with a production of 24.15lakh tons green pod and a productivity of 567.0 kg ha^{-} during 2015-16 (Meena *et al*, 2016). In Punjab, cluster bean was cultivated on area 48600 ha with production of 33400 tons and average productivity was 688.0 kg ha^{-1}during 2015-16 (Anonymous, 2016).

Cluster bean is poor competitor with weeds. As a guar is a rainy season crop and due to frequent rains the weed population increases tremendously which compete for nutrients, moisture and space with main crop causing considerable yield reduction. Critical crop weed competition is from 20-30 DAS (Patel *et al*, 2005). Guar crop is infested with both grass and broadleaved weeds. 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 (Sonani *et al*, 1985). 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 is only recommended herbicides in the Punjab 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. Thus, present investigation was carried out to find out some suitable post emergence herbicide and optimize the application doses in cluster bean.

MATERIALS AND METHODS

A field experiment was carried out at Regional Station, Bathinda under AICRP on Arid Legumes during *kharif* 2015 and 2016. The experimental region is situated in trans-Gangetic agro-climatic zone, representing the Indo-Gangetic alluvial plains at 30°09''36' N latitude, 74°55''28' E longitude and at an altitude of 211 m above sea level. The soil of experimental site was sandy loam, medium in available N (275 kg/h and 281.5 kg/ha), P (16.8 and 19 kg/ha), K (221.4 and 221.7 kg/ha), medium in organic carbon content (0.59 &0.61%) and slightly alkaline in reaction with pH 8.2 and 8.19.The experiment layout was comprised of nine treatment combinations, *viz.* T1: One Inter-cultivation at 20-25DAS, T2: Pendimethalin @ 0.75 kg a.i./ha as PE, T3: Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds, T4: Imazethapyr+ Imazamox @ 40g a.i./ha at 2-3 leaf stage of

*Corresponding author's e-mail: brarsehaj@pau.edu

weeds, T5: T2+T3 (pre + Post), T6: T2+T1 (Pre + Inter culture), T7: T2+ T4 (Pre +Post), T8: Weed free check and T9: Weedy Check. All herbicides were applied with knap-sack sprayer fitted with flat fan nozzle with discharge rate of 600 liter water/ha. These treatments were evaluated in randomized complete block design with three replications. Cluster bean variety 'HG -365' was sown in first fortnight of July at 45 cm row to row and 10 cm plant to plant spacing with a seed rate of 20 kg/ha during both the years. The pre-sowing irrigation was given for sowing the crop. Fertilizer were applied uniformly through urea and DAP @ 20 kg N and 40 kg P_2O_5/ha Recommended package of practices were followed for successful cultivation of crop. Rainfall received during the crop period was 353.7 and 490.3 mm during 2015 and 2016.

The weeds were uprooted randomly at one place by quadrate of one square metre with the help of *khurpi* in each plot. The weeds were oven dried for ten days and their weight was recorded in gram. Weed control efficiency of various treatments were worked out with the help of following formula.

Weed control efficiency: Weed Control Efficiency (WCE) was calculated by using the following formula

$$\text{Weed control efficiency (\%)} = \frac{X-Y}{X} \times 100$$

Where,

X = Dry matter of weeds in un-weeded plot.

Y = Dry matter of weeds in treated plot.

Weed index: The weed index (WI) was calculated by using the following formula.

$$WI = \frac{X-Y}{X} \times 100$$

Where,

X = Yield from weed free plot

Y = Yield from other treated plot.

The data collected on various aspects of the investigations were statistically analyzed as prescribed by Cochran and Cox (1967) and adapted by Cheema and Singh (1991) in statistical package CPCS-1.The comparisons were made at 5 per cent level of significance.

RESULTS AND DISCUSSION

Cluster bean faces acute crop weed competition due to slower crop growth rate as compared to weeds at initial growth stages. Experiment results showed that weed dry matter was minimum in weed free treatment at each stage as experimental plots were kept neat and clean during entire crop season. AAt 20 DAS, among weed control treatments, weed dry matter was lowest in Pendimethalin @ 0.75 kg a.i./ha as PE (T_2). This shows that Pendimethalin was effective up to 20 DAS which was closely followed by Pendimethalin @ 0.75 kg a.i./ha as PE+ Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds (T_5), Pendimethalin @ 0.75 kg a.i./ha as PE+ One Intercultivation at 20-25 DAS (T_6) and Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr+ Imazamox @ 40g a.i./ha at 2-3 leaf stage of weeds (T_7). At 40 DAS, Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr+ Imazamox @ 40g a.i./ha at 2-3 leaf stage of weeds (T_7) and Imazethapyr+ Imazamox @ 40g a.i./ha at 2-3 leaf stage of weeds (T_4)was better than other weed control treatments. Similar trend was observed at harvest. Jain *et al.* (2009) observed similar results at Udaipur, Rajasthan

Further, data revealed that highest weed control efficiency (Table 4) was observed in weed free check (100%), this was mainly due the reason that, the regular weeding at emergence of weeds made sure that the weeds were practically absent in this treatment followed Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr+ Imazamox @ 40g a.i./ha at 2-3 leaf stage of weeds (T_7), Pendimethalin @ 0.75 kg a.i./ha as PE+ One Intercultivation at 20-25 DAS (T_6) and Pendimethalin @ 0.75 kg a.i./ha as PE+ Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds (T_5) while Weed Index (Table 4) was highest in Pendimethalin @ 0.75 kg a.i./ha as PE+ Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds (T_5) followed by Pendimethalin @ 0.75 kg a.i./ha as PE+

Table 1: Growth, yield attributes of cluster bean as influenced by different weed management practices during 2015 and 2016 at RRS, Bathinda.

Treatment	Plant height (cm)		Pods/plant		Seeds/pod		100 seed weight (g)	
	2015	2016	2015	2016	2015	2016	2015	2016
T1: One Intercultivation at 20-25 DAS	67.0	112.3	13.9	24.0	5.2	5.7	2.35	2.40
T2: Pendimethalin @ 0.75 kg a.i./ha as PE	59.4	95.3	13.0	22.7	5.2	5.8	2.34	2.38
T3: Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds	62.0	100.2	14.0	24.8	5.1	5.7	2.36	2.42
T4: Imazethapyr+ Imazamox @ 40g a.i./ha at 2-3 leaf stage of weeds	59.8	97.6	15.6	25.0	5.2	5.9	2.36	2.43
T5: T2+T3 (PE + PoE)	63.6	100.7	16.7	27.1	5.7	6.2	2.35	2.41
T6: T2+T1 (PE+ Inter culture)	56.8	94.9	18.2	27.9	5.5	5.9	2.35	2.41
T7: T2+ T4 (PE + PoE)	51.1	91.3	18.0	27.3	5.3	5.7	2.34	2.36
T8: Weed free check	54.7	93.6	18.6	29.7	5.6	6.1	2.38	2.44
T9: Weedy Check	64.6	103.6	10.2	21.9	4.5	5.3	2.34	2.36
CD (p=0.05)	**NS**	**8.87**	**3.0**	**2.64**	**0.41**	**0.49**	**NS**	**NS**
CV (%)	**9.24**	**5.29**	**11.16**	**5.98**	**4.47**	**4.99**	**3.54**	**1.93**

Table 2: Growth, yield attributes and yield (kg/ha) of cluster bean as influenced by different weed management practices during 2015 and 2016 at RRS, Bathinda.

Treatment	Seed yield (kg/ha)		Dry fodder yield (kg/ha)	
	2015	2016	2015	2016
T1: One Intercultivation at 20-25DAS	318.8	1135.7	2035.0	1984.3
T2: Pendimethalin @ 0.75 kg a.i./ha as PE	293.6	1023.4	1935.7	1894.3
T3: Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds	324.4	1160.4	1987.9	1920.3
T4: Imazethapyr+ Imazamox@ 40g a.i./ha at 2-3 leaf stage of weeds	368.7	1326.2	1932.8	1876.3
T5: T2+T3 (PE + PoE)	390.6	1423.4	1984.3	1912.0
T6: T2+T1 (PE+ Inter culture)	397.6	1419.3	1909.6	1885.3
T7: T2+ T4 (PE + PoE)	393.5	1400.9	1957.0	1900.0
T8: Weed free check	426.9	1549.3	2024.3	1974.0
T9: Weedy Check	193.1	613.9	1757.8	1912.0
CD (p=0.05)	**67.2**	**298.74**	**NS**	**NS**
CV (%)	**11.25**	**14.06**	**6.63**	**6.14**

Table 3: Weed dry matter (g/m^2) at different crop growth stages of cluster bean under different weed management practices at RRS, Bathinda during 2015 and 2016.

Treatment	Weed dry matter (g/m^2) at 20 DAS		Weed dry matter (g/m^2) at 40 DAS		Weed dry matter (g/m^2) at harvest	
	2015	2016	2015	2016	2015	2016
T1: One Intercultivation at 20-25 DAS	2.619 (5.85)*	2.51 (5.32)	1.60 (1.70)	1.63 (1.66)	3.90 (14.28)	4.04 (15.33)
T2: Pendimethalin @ 0.75 kg a.i./ha as PE	1.55 (1.40)	1.59 (1.54)	3.08 (8.50)	3.07 (8.53)	4.34 (17.90)	4.42 (18.50)
T3: Imazethapyr @ 40g a.i./ ha at 2-3 leaf stage of weeds	2.41 (4.85)	2.26 (4.13)	1.91 (2.65)	1.90 (2.69)	4.13 (16.08)	4.29 (17.37)
T4: Imazethapyr+ Imazamox @ 40g a.i./ha at 2-3 leaf stage of weeds	2.26 (4.13)	2.22 (3.93)	1.59 (1.55)	1.60 (1.72)	3.45 (10.95)	3.53 (11.47)
T5: T2+T3 (PE + PoE)	1.62 (1.65)	1.65 (1.71)	1.84 (2.42)	1.86 (2.55)	3.64 (12.27)	3.75 (13.03)
T6: T2+T1 (PE+ Inter culture)	1.56 (1.47)	1.56 (1.43)	1.67 (1.78)	1.64 (1.73)	3.49 (11.22)	3.64 (12.28)
T7: T2+ T4 (PE + PoE)	1.60 (1.57)	1.61 (1.59)	1.50 (1.25)	1.49 (1.34)	3.20 (9.26)	3.33 (10.10)
T8: Weed free check	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
T9: Weedy Check	2.67 (6.16)	2.67 (6.12)	4.71 (21.28)	4.73 (21.25)	5.36 (27.98)	5.48 (29.10)
CD (p=0.05)	**0.29**	**0.33**	**0.25**	**0.45**	**0.52**	**1.17**
CV (%)	**8.66**	**6.69**	**6.93**	**5.60**	**8.30**	**5.80**

*Values in parenthesis are original values and data is subject to square root transformation

Table 4: Weed control efficiency (WCE) and weed index (WI) at harvest of cluster bean under different weed management practices at RRS, Bathinda.

Treatment	WCE (%)	WI (%)
T1: One Intercultivation at 20-25DAS	48.11	26.70
T2: Pendimethalin @ 0.75 kg a.i./ha as PE	36.19	33.94
T3: Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds	41.39	25.10
T4: Imazethapyr+ Imazamox@ 40g a.i./ha at 2-3 leaf stage of weeds	60.71	14.40
T5: T2+T3 (PE + PoE)	55.65	8.13
T6: T2+T1 (PE+ Inter culture)	58.83	8.39
T7: T2+ T4 (PE + PoE)	66.07	9.58
T8: Weed free check	100.00	-
T9: Weedy Check	-	60.38

One Intercultivation at 20-25 DAS (T_6) & Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr+ Imazamox @ 40g a.i./ha at 2-3 leaf stage of weeds (T_7). Godara and Singh (2015) at Ajmer also reported higher weed control efficiency in weed free treatment followed by PoE herbicide Imazethapyr @60 g/ ha at 20 DAS.

The perusal of data revealed that highest seed yield 426.9 kg/ha was recorded in weed free check during 2015 followed by Pendimethalin @ 0.75 kg a.i./ha as PE+ One Intercultivation at 20-25 DAS (T_6), Pendimethalin @ 0.75 kg a.i. /ha PE + Imazethapyr @ 40 g a.i. /ha PoE at 25 DAS (T_7) and Pendimethalin @ 0.75 kg a.i./ha as PE+

Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds (T_5) and 1549.3 q/ha during 2016 followed by Pendimethalin @ 0.75 kg a.i./ha as PE+ Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds (T_5), Pendimethalin @ 0.75 kg a.i./ha as PE+ One Intercultivation at 20-25 DAS (T_6) and Pendimethalin @ 0.75 kg a.i. /ha PE + Imazethapyr @ 40 g a.i. /ha PoE at 25 DAS (T_7), respectively but these three treatments were at par with each other during both the years(Table 2).This may be due to additive effect of number of pods/plant, no. of seeds/pod (Table1). The results were in closed conformity with the finding of Singh *et al.* (2016).Similarly, weed dry matter (Table 3) was lowest in case of Weed free check (T_8) followed by Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr + Imazamox @ 40g a.i./ha at 2-3 leaf stage of weeds(T_7).

CONCLUSION

Based on the findings of two year study, present study thus, concludes, that effective control of weeds and improved productivity can be attained with the application of Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr @ 40g a.i./ha at 2-3 leaf stage of weeds or Pendimethalin @ 0.75 kg a.i./ha as PE + Imazethapyr+ Imazamox @ 40g a.i./ ha at 2-3 leaf stage of weeds. The experiment may be repeated under different agro-climatic conditions to confirm the result obtained from the present investigation

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