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Weed Management in Vegetable Cluster Bean (*Cyamopsis tetragonoloba*)

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A B S T R A C T

A field experiment was conducted during *kharif* season of 2017 and 2018 at Agriculture Research Sub Station, Kotputli, Jaipur, where four herbicides either as integrated with hand weeding or sequentially applied were evaluated for efficacies of the herbicides on controlling weeds, their influences on green pod yield of vegetable cluster bean in randomized block design with four replications. The results of two-year experimentation indicated that all the weed control treatment gave significantly minimum dry weight of weed and higher green pod yield over no weeding. In pooled data based on both the years, the treatment of weed free check was found highest value of green pod yield (44.53 q/ha). It was found at par with two hand weeding at 20 and 40 DAS(44.06 q/ha), Pendimethalin @ 1.0 kg ai. /ha as pre-emergence & one hand weeding at 25 DAS (43.41 q/ha) and Imazathyper 10 SL@ 40 g ai. /ha at 15-20 DAS (42.98 q/ha). Highest weed control efficiency and minimum weed index were observed in weed free check. Among various herbicides treatments, Imazathyper 10 SL@ 40 g ai. /ha at 15-20 DAS showed highest B:C ratio in both the years and it was significant differ over the rest of treatments. In monetary term imazathyper 10 SL@ 40 g ai. /ha recorded higher net return (Rs.85948/ha) and benefit: cost ratio (3.0) over weed free check (Rs.79590/ha and 2.47, respectively)

Introduction

Cluster bean (*Cyamopsis tetragonoloba*) commonly known as guar crop, is a drought and high temperature tolerant, deep rooted, summer annual legume of high social and economic significance. Guar has experienced a remarkable journey from a traditional crop grown on marginal lands mainly for food, animal feed and fodder to a crop with various industrial usages ranging from textile, food processing, cosmetics, mining, explosive, oil and pharmaceutical industries, printing, toilet goods etc. India is the largest producer of guar and contributes 80% of total guar production in the world. India is the major exporter of guargum to the world; it exports various forms of Guar products to a large number of

countries. The country has exported 3,81,880.16 MT of guargum to the world for the worth of Rs. 3,261.60 crores/456.96 USD Millions during the year 2019-20 (Anonymous, 2020). During last three years, guar gum had topped the list of India's top agricultural export commodity in terms of value (Anonymous 2015). The significantly higher prices of guar in recent time have helped expand the crop to non-traditional regions and seasons.

In India, cluster bean is mostly grown in Rajasthan, Haryana, Punjab, Uttar Pradesh and Madhya Pradesh. Rajasthan occupies first position in India both in area and production. It accounts for almost 82.1 per cent area and 70% production in India. Haryana and Gujarat have second and third position respectively. Rajasthan has an area of 46.30 lakh hectare, production of 27.47 M tones with a productivity of 593 kg/ha. (Anonymous, 2015). In Rajasthan, guar is mainly grown in Barmer, Churu, Sriganganagar, Nagaur, Jalore, Sikar, Jaisalmer, Bikaner, Jaipur, Jhunjhunu and Alwar districts. Cluster bean occupies a significant place at the national level as well as the state level. India is the leading exporter of guar seed and guar gum. The major importing countries of India guar products are Europe, USA, China, UK, South Africa and Japan.

It is well known that weeds are ubiquitous but their presence in cropped area particularly in rainy season crops like vegetable clusterbean act as major limiting factor in achieving potential harvest. Inadequate weed control is one of the main factors related to decrease in clusterbean production. In India, farmers rely predominantly on mechanical manual methods of weed control. But, these practices alone do not ensure weed free conditions and are expensive, cumbersome and time-consuming too and further reducing the profit margin. Vegetable clusterbean crop is cultivated mainly in the north-western part of country during *kharif* and summer season where inadequate weed management is a major constraint in harnessing its production potential. Yield reduction due to weed infestation is to the tune of 53.7% has been observed (Saxena *et al.*, 2004). Hence, the present investigation was undertaken to find out an effective and economical viable weed management practices for summer cluster bean.

Materials and Methods

A field experiment was conducted at Agriculture Research Sub Station, Kotputli, Jaipur, Sri Karn Narendra Agriculture University, Jobner, Jaipur during the *kharif* 2017 and 2018. Seven treatments comprising pendimethalin @ 1.0 kg ai. per hectare as pre emergence, pendimethalin @ 1.0 kg ai.per hectare as pre emergence with one hand weeding at 25 days after sowing, imazathyper 10 SL@ 40 g a.i. per hectare at 15-20 days after sowing, quazilfop ethyl @ 37.5 g a.i. per hectare 15-20 days after sowing, hand weeding at 20 and 40 days after sowing, weed free and unweeded control were tried in randomized block design with four replications. Gross and net plot size was 4.80 m x 2.70 m and 3.60 m x 1.80 m, respectively. Cluster bean variety M-83 was sown with recommended package of practices except weed management. Fertilizers were applied @ 20 kg N and 40 kg P_2O_5 per hectare uniformly through urea and DAP. Data on weed growth and yield performance were recorded.

Results and Discussion

Weed flora of experimental field comprised *Cynodon dactylon, Cyperus rotundus, Echinochloa colona, Echinochloa crus-galli* among monocot weeds and *Amaranthus viridis, Amaranthus spinosus, Commelina*

benghalensis, *Parthenium hysterophorus* and *Trianthema portulacastrum* among dicot weeds.

The minimum dry weight of weed was recorded in two hand weeding at 20 and 40 DAS (261.63 kg/ha) followed by Pendimethalin @ 1.0 kg ai./ha as pre emergence & one hand weeding at 25 DAS (281.25 kg/ha) and then Imazathyper 10 SL@ 40 g ai./ha at 15-20 DAS (301.75 kg/ha) on pooled basis of data of both the years. However, the maximum dry weight was recorded in weedy check (1476 kg/ha)

On the basis of pooled data, the highest green pod yield was recorded in weed free (44.53q/ha) and the lowest was under unweeded check (21.03 q/ha). The yield loss due to uncontrolled growth of weeds as compared to weed free. The data revealed that the maximum green pod yield was recorded in weed free (44.53q/ha) followed by treatment two hand weeding at 20 and 40 DAS (44.06 q/ha), Pendimethalin @ 1.0 kg ai./ha as pre emergence & one hand weeding at 25 DAS (43.41 q/ha) and Imazathyper 10 SL@ 40 g ai./ha at 15-20 DAS (42.98 q/ha), respectively. All these treatments remains at par with each other in this study. This might be due to effective and efficient control of weeds by integration of hand weeding and pre-emergence and post emergence of herbicides.

The highest net returns (Rs. 85948/ha) was obtained under treatment Imazathyper 10 SL@ 40 g ai./ha at 15-20 DAS which was significantly at par with Pendimethalin @ 1.0 kg ai./ha as pre emergence & one hand weeding at 25 DAS and Hand weeding at 20 and 40 DAS. Similarly, highest B:C ratio (3.0) was recorded in Imazathyper 10 SL@ 40 g ai./ha at 15-20 DAS which was significantly higher than other treatments. The higher benefits obtained under these treatments were also due to comparatively less cost of herbicides than hand weeding as well as higher seed and stover yield of cluster bean. These finding are in agreement with those of Reager *et al.*, (2003), Saras *et al.*, (2014), Yadav *et al.*, (2011) (Fig. 1–3 and Table 1–3).

Table.1 Weed growth and yield of vegetable cluster bean as influenced by weed management treatments

Treatment	Dry weight of weeds (kg/ha)			Green pod yield (q/ha)		
	2017	2018	Pooled	2017	2018	Pooled
T_1 : Weedy check	1545	1407	1476	19.23	22.83	21.03
T_2 : Hand weeding at 20 and 40 DAS	241.25	282	261.625	42.73	45.40	44.06
T_3 : Pendimethalin @ 1.0 kg ai./ha as pre emergence	576	648	612	33.13	36.13	34.63
T_4 : Pendimethalin @ 1.0 kg ai./ha as pre emergence & one hand weeding at 25 DAS	268.75	293.75	281.25	41.73	45.08	43.41
T_5 : Imazathyper 10 SL@ 40 g ai./ha at 15-20 DAS	282.25	321.25	301.75	41.40	44.57	42.98
T_6 : Quazilfop ethyl @ 37.5 g ai./ha 15-20 DAS	495	559	527	36.83	39.63	38.23
T_7 : Weed free	0	0	0	42.94	46.12	44.53
S.Em±	12.98	6.69	7.30	0.90	0.75	0.59
C.D. (5%)	38.58	19.87	20.95	2.66	2.24	1.68

Table.2 Economic feasibility of different weed management treatment on vegetable cluster bean

Treatment	Gross returns (Rs./ha.)			Net returns (Rs./ha.)			B:C ratio		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
T_1 : Weedy check	57690	68490	63090	17690	28490	23090	1.44	1.71	1.58
T_2 : Hand weeding at 20 and 40 DAS	128175	136200	132188	78175	86200	82188	2.56	2.72	2.64
T_3 : Pendimethalin @ 0.5 kg ai./ha as pre emergence	99390	108390	103890	57390	66390	61890	2.37	2.58	2.47
T_4 : Pendimethalin @ 1.0 kg ai./ha as pre emergence & one hand weeding at 25 DAS	125190	135240	130215	78190	88240	83215	2.66	2.88	2.77
T_5 : Imazathyper 10 SL@ 40 g ai./ha at 15-20 DAS	124185	133710	128948	81185	90710	85948	2.89	3.11	3.00
T_6 : Quazilfop ethyl @ 37.5 g ai./ha 15-20 DAS	110490	118890	114690	68490	76890	72690	2.63	2.83	2.73
T_7 : Weed free	128820	138360	133590	74820	84360	79590	2.39	2.56	2.47
S.Em±	2690	2262	1757	2690	2262	1757	0.06	0.05	0.04
C.D. (5%)	7991	6722	5040	7991	6722	5040	0.17	0.15	0.11

Table.3 Effect of different weed management treatment on weed index and weed efficiency on vegetable cluster bean

Treatment	Weed index			Weed control efficiency		
	2017	2018	Pooled	2017	2018	Pooled
T_1 : Weedy check	55.22	50.50	52.77	-	-	-
T_2 : Hand weeding at 20 and 40 DAS	0.50	1.56	1.05	84.39	79.96	82.27
T_3 : Pendimethalin @ 0.5 kg ai./ha as pre emergence	22.85	21.66	22.23	62.72	53.94	58.54
T_4 : Pendimethalin @ 1.0 kg ai./ha as pre emergence & one hand weeding at 25 DAS	2.82	2.25	2.53	82.61	79.12	80.95
T_5 : Imazathyper 10 SL@ 40 g ai./ha at 15-20 DAS	3.60	3.36	3.48	81.73	77.17	79.56
T_6 : Quazilfop ethyl @ 37.5 g ai./ha 15-20 DAS	14.23	14.07	14.15	67.96	60.27	64.30
T_7 : Weed free	0.00	0.00	0.00	100.00	100.00	100.00

Fig.1 Dry weight of vegetable cluster bean as influenced by weed management treatments

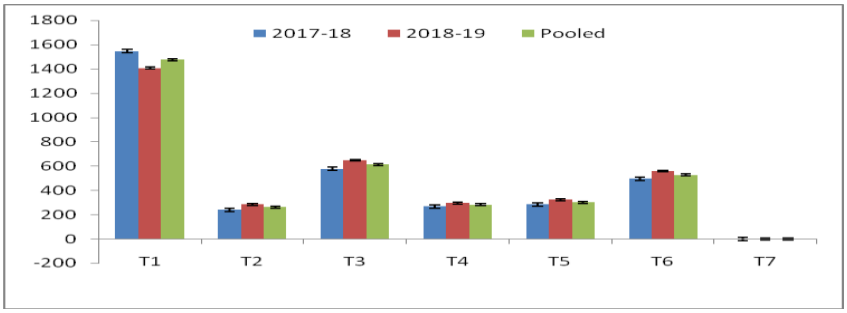


Fig.2 Green pod yield of vegetable cluster bean as influenced by weed management treatments

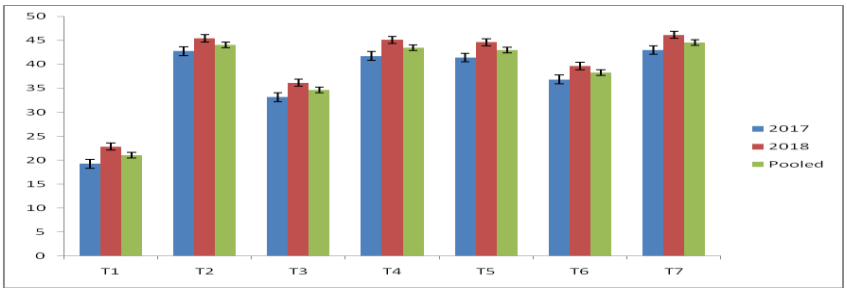
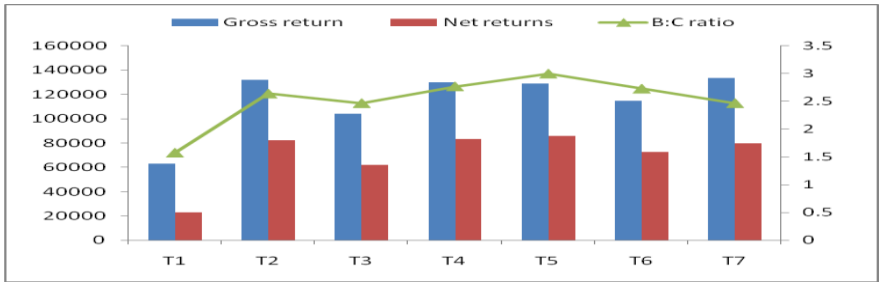


Fig.3 Economic feasibility of different weed management treatment on vegetable cluster bean



On the basis of pooled data of both the years, the minimum weed index was observed in Hand weeding at 20 and 40 DAS followed by Pendimethalin @ 1.0 kg ai./ha as pre emergence & one hand weeding at 25 DAS and Imazathyper 10 SL@ 40 g ai./ha at 15-20 DAS while highest weed index was found in Treatment weedy check. The maximum weed control efficiency was recorded in weed free treatment followed by Hand weeding at 20 and 40 DAS, Pendimethalin @ 1.0 kg ai./ha as pre emergence & one hand weeding at 25 DAS and Imazathyper 10 SL@ 40 g ai./ha at 15-20 DAS. The lowest weed control efficiency was recorded in treatment Pendimethalin @ 0.5 kg a.i./ha as pre emergence

It can be concluded that maximum net returns and benefit : cost ratio in clusterbean could be realized with the integrated application of imazethapyr 100 g/ha at 20 DAS+one hand weeding at 35 DAS under sub humid southern plain and Aravalli hills zone of Rajasthan (Hemraj Dhaker *et al* 2009). Among different herbicides imazethapyr 60 g at 20 DAS showed highest values of yield in cluster bean (Godara and Ravindra, 2015).

On the basis of the results of the present two year field study, it can be concluded that effective and economically viable weed management in vegetable cluster bean on clayey soil can be achieved by application of imazathyper 10 SL@ 40 g ai./ha at days after sowing Alternatively, maintaining the crop weed free throughout crop growth period OR adopting spray of Pendimethalin @ 1.0 kg ai./ha as pre emergence & one hand weeding at 25 DAS days after sowing can be employed according to availability of labours.

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