

Effect of Weed Management Practices on Growth, Yield Attributes and Yield of Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub]

ABSTRACT

Weed management treatments influence growth, yield attributes and yield in clusterbean. The present study aimed to assess the effect on growth, yield attributes and yield by weed management practices. An agronomic investigation was carried out at Agricultural Research Station, Mandor, Agriculture University, Jodhpur, Rajasthan during *Kharif* 2018. The experiment laid down in a randomized block design (RBD) with three replications. The experiment comprising of ten treatments *i.e.* W₁-weedy check, W₂-weed free, W₃-pendimethalin at 750 g/ha (PE), W₄-imazethapyr at 40g/ha (early post-emergence), W₅-pendimethalin + imazethapyr at 750 g/ha (PE), W₆-imazethapyr + imazamox at 50 g/ha (early post-emergence), W₇-pendimethalin at 750 g/ha (PE) + 1 HW at 25 DAS, W₈-imazethapyr at 40 g/ha (early post-emergence) + 1 HW at 35 DAS, W₉-pendimethalin + imazethapyr at 750 g/ha (PE) + 1 HW at 25 DAS and W₁₀-imazethapyr + imazamox at 50 g/ha (early post-emergence) + 1 HW at 35 DAS. Early post-emergence application of imazethapyr + imazamox at 50 g/ha + 1 HW at 35 DAS recorded significantly higher growth, yield attributes and yield *viz.*, dry matter/plant (g), plant height(cm), number of branches/plant, number of pods/plant, number of seeds/pod, 1000-seed weight (g), yields (seed and stover) and harvest index over control and it was at par with treatment application of imazethapyr at 40 g/ha (early post-emergence) + 1 HW at 35 DAS and weed free. Application of imazethapyr + imazamox at 50 g/ha + 1 HW at 35 DAS in *Kharif* clusterbean found suitable preposition to achieve the highest yield as well as net monetary returns.

Keywords: Clusterbean, growth attributes, yield attributes and yield

1. INTRODUCTION

Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub] is commonly known as “Guar”. The primary centre of origin of clusterbean is India (Vavilov, 1951). It is an important cash crop of rainfed areas, particularly in semi-arid and arid regions of India. Guar plant produces a cluster of flowers and pods so, it is also known as clusterbean. This crop belongs to the family fabaceae and sub family papilionaceae. It is well adopted to the conditions existing in Rajasthan and is being grown in areas receiving annual rainfall from 350 to 750 mm. Rajasthan is a major clusterbean growing state of India having area of 2.39 million hectares and production 1.0 million tonnes and productivity of 419 kg/ha of clusterbean. (Anon., 2022). Clusterbean is grown for different purposes *viz.*, vegetable, green fodder, green manuring and seed. The gum content in the endosperm of its seed (28-33 per cent) has several industrial uses *viz.*, textiles, paper, petroleum, pharmaceuticals, food processing, cosmetics, mining explosives, oil drilling etc. thus making it a good foreign exchange earner (Kumawat *et al.*, 2017). Pulses occupy a unique position in every system of Indian farming as a main, catch, cover, green manure and intercrop. Lack of improved cultural practices, cultivation on marginal and sub marginal lands of poor fertility, inadequate fertilization, monsoon dependent cultivation and non-availability of suitable varieties are the major factors responsible for low yield of clusterbean. Along with these, weed infestation is one of the major constraints in clusterbean cultivation. Being a rainy season crop, it

is invaded by a large number of fast growing weeds. There is an acute crop-weed competition during early crop growth stage due to slow initial crop growth and weeds grow at faster speed. Weeds infects vigorously due to frequent rains and presence of weeds beyond critical period of crop-weed competition results in yield reduction to the tune of 40-45 per cent (Sangwan *et al.*, 2016). The competition between crop and weeds caused 53.7 per cent reduction in seed yield (Singh *et al.*, 2008). Among different weed management practices, hand weeding is traditional and efficient option but unavailability of labour at peak weeding periods and increasing labour cost oblige major limitations on economic feasibility of manual weeding (Singh and Godara, 2015). A judicious combination of chemical and cultural methods of weed control would not only reduce the expenditure on herbicides but would benefit the crop by providing proper aeration and conservation of moisture (Prakash *et al.* 1991). Pre-emergence application of pendimethalin is recommended in this region but if pre-emergence herbicide is skipped due to one or another reason, hence post-emergence application of herbicide is effective and gives control mixed flora of narrow and broad-leaved weeds *viz.*, *Digera arvensis*, *Tribulus terrestris*, *Corchorus trilocularis* *Phyllanthus niruri*, *Amaranthus viridis*, *Celosia argentea* and *Portulaca oleracea* among broad-leaved weeds and *Eragrostis minor*, *Cyperus rotundus*, *Cynodon dactylon* and *Dactyloctenium aegyptium*. The present investigation was taken up with an objective to find out suitable weed management practice for control of weeds in clusterbean.

2. MATERIALS AND METHODS

Soil characterization: The three primary elements (N, P, K) present in soil were analysed by using alkali potassium permanganate method (Subbiah and Asija, 1956), Olsen method (Olsen 1954) and flame photometer method (Jackson, 1973), respectively. The pH (Richards, 1954) and organic carbon (Walkley and Black, 1934) were also measured. The homogeneous composite soil samples were collected to appropriate analysis. The soil was loamy sand in texture, soil bulk density (1.77 Mg/M^3) slightly alkaline (pH 8.2) having low organic carbon (1.3 g/kg), medium in available nitrogen (174.0 kg/ha), medium in available phosphorus (22.0 kg/ha) and high in availability potash (325.0 kg/ha) with electrical conductivity (0.12 ds/m).

A field investigation was conducted during *Kharif* 2018 at Agricultural Research Station, Mandor (Agriculture University, Jodhpur). Geographically situated between $26^{\circ}15'$ N to $26^{\circ}45'$ north latitude and $73^{\circ}00'$ E to $73^{\circ}29'$ East longitude and an altitude of 231 m above from mean sea-level under the category of western dry region agro-climatic zone. Fig. 1 shows weather parameters during crop season. The experiment laid down in a randomized block design (RBD) with three replications. The experiment comprising of ten treatments *i.e.* W₁-weedy check, W₂-weed free, W₃-pendimethalin at 750 g/ha (PE), W₄-imazethapyr at 40g/ha (early post-emergence), W₅-pendimethalin + imazethapyr at 750 g/ha (PE), W₆-imazethapyr + imazamox at 50 g/ha (early post-emergence), W₇-pendimethalin at 750 g/ha (PE) + 1 HW at 25 DAS, W₈-imazethapyr at 40 g/ha (early post-emergence) + 1 HW at 35 DAS, W₉-pendimethalin + imazethapyr at 750 g/ha (PE) + 1 HW at 25 DAS and W₁₀-imazethapyr + imazamox at 50 g/ha (early post-emergence) + 1 HW at 35 DAS. In rainy season, clusterbean variety RGC-1017 was used as a test crop in rows 30 cm apart using a seed rate of 15 kg/ha. General recommended dose of nutrients were *i.e.* 10 kg N and 40 kg P₂O₅/ha was applied through urea and DAP. Complete dose of nitrogen and phosphorus were applied as a basal application. All the recommended package of practices of the zone were followed for growing the crop except weed management.

Analysis of plant growth, yield attributes and yield: The observations on dry matter/plant (g), plant height (cm), number of branches/plant, number of pods/plant and number

of seeds/pod were recorded manually by randomly selecting five representative plants from each plot of each replication. Yield and yield attributes were also recorded. The seed and stover yield was recorded from net plot area of each treatment. Comprehensive statistical analysis (treatment mean, standard error mean, critical difference and range of variation) and test of significance test (F-test) were carried out for each trait. For this, entire biometric data recorded during the course of investigation were compiled in proper tables and statistically analyzed by using the standard procedures of statistical analysis for randomized block design suggest by Gomez and Gomez (1984).

Application of treatments :According to treatments, pendimethalin and its ready mix with imazethapyr was applied as pre-emergence (within 2 DAS), while imazethapyr and its ready mix with imazamox was applied as early post-emergence (20 DAS). A knap-sack sprayer was used for spraying the herbicides using a spray volume of 800 litre/ha. In the plots ear marked for hand weeding, the operation was done at 25 and 35 days after sowing as per the treatments.

3. RESULTS AND DISCUSSION

The major weed flora founded throughout crop season revealed that weedy check plots were heavily invaded by broad leaved weeds chiefly *Digera arvensis*, *Tribulus terrestris*, *Corchorus trilocularis*, *Phyllanthus niruri*, *Amaranthus viridis*, *Celosia argentea* and *Portulaca oleracea* and *Eragrostis minor*, *Cyperus rotundus*, *Cynodon dactylon* and *Dactyloctenium aegyptium* among narrow leaved weeds. *Digera arvensis* and *Tribulus terrestris* were found to be the prominent broad leaved weeds.

3.1 Effect on growth attributes:

In present study, weed management treatments were significantly increased the growth parameters of clusterbean, viz., dry matter/plant (g), plant height (cm) and number of branches/plant during crop season. The crop dry matter was significantly increased with application of herbicide (Table 1). The application of imazethapyr + imazamox 50 g/ha recorded dry matter of 27.0 g but when this treatment was super imposed with one hand weeding at 35 DAS, the plant dry matter was further significantly improved by 28.8%. Highest plant height (65.1 cm) was recorded with application of imazethapyr + imazamox at 50 g/ha + 1 HW at 35 DAS which was 73.6% higher over control. Imazethapyr + imazamox at 50 g/ha + 1 HW at 35 DAS, imazethapyr at 40 g/ha(early post-emergence) + 1 HW at 35 DAS and pendimethalin + imazethapyr at 750 gm (PE) + 1 HW at 25 DAS were found among the most promising and equally effective treatments in improving the growth attributes of clusterbean (Table 1). These treatments registered 82.5, 81.3 and 79.7% higher branches/plant at harvest stage over weedy check plots, respectively. The growth attributes in the present investigation were further improved when herbicidal treatments were super imposed with weeding done between 25 to 35 DAS. It might be due to the availability of cleanest environment during the peak growth period as well as better conservation of soil moisture due to weeding in these treatments. The timely and effective control of weeds is expected to have better availability of moisture, nutrients and solar radiation to the crop plants, thereby increasing total chlorophyll content, photosynthetic rate and nitrate reductase activity (Suseendran *et al.*, 2020), resulting to higher rate of supply of carbohydrates which leading to higher increase in growth parameters. Significant improvement in growth determining character using imazethapyr + imazamox at 40 g/ha has also been reported by Singh *et al.* (2016) and Sharma *et al.* (2017) in clusterbean crop.

3.2 Effect on yield attributes and yield:

The highest pods per plant (45.3) were recorded under early post-emergence spary of imazethapyr + imazamox at 50 g/ha+ 1 HW at 35 DAS (Table 2). It was found significantly

superior over rest of the treatments except imazethapyr at 40 g/ha (early post-emergence) + 1 HW at 35 DAS. The highest number of seeds per pod (7.5) was achieved under imazethapyr + imazamox at 50 g/ha + 1 HW at 35 DAS that was statistically at par with weed free and imazethapyr at 40 g/ha (early post-emergence) + 1 HW at 35 DAS treatment. It registered 44.2% increase in seeds per pod over control. 1000-seed weight of clusterbean was significantly increased by weed management treatments. The yield with application of various weed management treatments influenced significantly over the control (Table 1). Significantly higher seed yield (1180 kg/ha) was recorded with application of imazethapyr + imazamox at 50 g/ha + 1 HW at 35 DAS which was at par with imazethapyr at 40 g/ha (early post-emergence) + 1 HW at 35 DAS and weed free. It resulted 461.9 and 421.0% higher seed and stover yield of clusterbean, respectively than control. This might be due to minimizing the competition of weeds with main crop for the resources specially nutrients, light, moisture and space with adoption of above referred herbicides super imposed with hand weeding under this treatment reduced crop-weed competition resulted into overall improvement of crop growth of clusterbean crop. All these factors consequently resulted into better development of the reproductive structures and translocation of photosynthates to the sink. The improvement in the yield components of the clusterbean could be attributed to increase in the growth characters of the crop. These results corroborate the findings of Singh *et al.* (2015), Singh *et al.* (2016), Sharma *et al.* (2017) and Yadav and Mundra (2017) in clusterbean.

4. CONCLUSION

Based on one year experiment, it may concluded that early post-emergence application of imazethapyr + imazamox at 50 g/ha + 1 HW at 35 DAS recorded higher growth, yield attributes and seed yield of clusterbean but equally effective with imazethapyr at 40 g/ha + 1 HW at 35 DAS. Keeping all views in mind, imazethapyr + imazamox at 50 g/ha + 1 HW at 35 DAS may be viable and taken for further research.

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Table 1. Effect of different weed management treatments on growth attributes of clusterbean

Treatments	Plant population (Lakh/ha)		Dry matter/plant (g)	Plant height (cm)	Number of branches (/plant)
	Initial	Final			
Weedy check	3.12	1.91	12.2	37.5	3.60
Weed free	3.20	3.18	35.2	65.8	7.67
Pendimethalin 750 g/ha (pre-em.)	3.18	2.25	23.3	44.3	4.47
Imazethapyr 40 g/ha(early post-em.)	3.11	2.27	23.6	45.6	4.53
Pendimethalin + imazethapyr 750 g/ha (pre-em.)	3.17	2.31	24.7	46.0	5.33
Imazethapyr + imazamox 50 g/ha (early post-em.)	3.15	2.69	27.0	53.0	5.40
Pendimethalin 750 g/ha (Pre-em.) + 1 HW at 25 DAS	3.19	2.77	27.4	53.4	5.47
Imazethapyr 40 g/ha (early post-em.) + 1 HW at 35 DAS	3.16	3.07	32.5	63.6	6.53
Pendimethalin + imazethapyr 750g/ha (pre-em.)+ 1 HW at 25 DAS	3.19	2.78	28.7	55.5	6.47
Imazethapyr + imazamox 50 g/ha (early post-em.) + 1 HW at 35 DAS	3.19	3.11	34.8	65.1	6.57
S Em ±	0.12	0.11	0.78	2.07	0.28
CD (P=0.05)	NS	0.34	2.33	6.16	0.86

Table 2. Effect of different weed management treatments on yield attributes, yield and harvest index of clusterbean

Treatments	Pods/plant (No.)	Seeds/pod (No.)	1000-seed weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest Index (%)
Weedy check	22.0	5.2	26.4	210.0	641.0	24.67
Weed free	48.2	7.7	34.0	1237.0	3503.0	26.09
Pendimethalin 750 g/ha (pre-em.)	29.4	5.8	29.5	694.0	2097.0	24.86
Imazethapyr 40 g/ha (early post-em.)	31.0	5.8	29.7	713.0	2140.0	24.99
Pendimethalin + imazethapyr 750 g/ha (pre-em.)	31.5	5.9	29.8	752.0	2257.0	24.99
Imazethapyr + imazamox 50 g/ha (early post-em.)	35.9	6.7	30.6	893.0	2670.0	25.06

Pendimethalin 750 g/ha (pre-em.) + 1 HW at 25 DAS	38.6	6.7	30.8	903.0	2711.0	25.01
Imazethapyr 40 g/ha (early post-em.) + 1 HW at 35 DAS	43.4	7.4	33.2	1120.0	3240.0	25.68
Pendimethalin + imazethapyr 750g/ha (pre-em.)+ 1 HW at 25 DAS	38.6	6.8	31.0	975.0	2923.0	25.01
Imazethapyr + imazamox 50 g/ha (early post-em.) + 1 HW at 35 DAS	45.3	7.5	33.5	1180.0	3340.0	26.10
S Em ±	1.39	0.19	0.96	44.23	106.02	0.96
CD (P=0.05)	4.16	0.59	2.88	131.44	315.03	NS

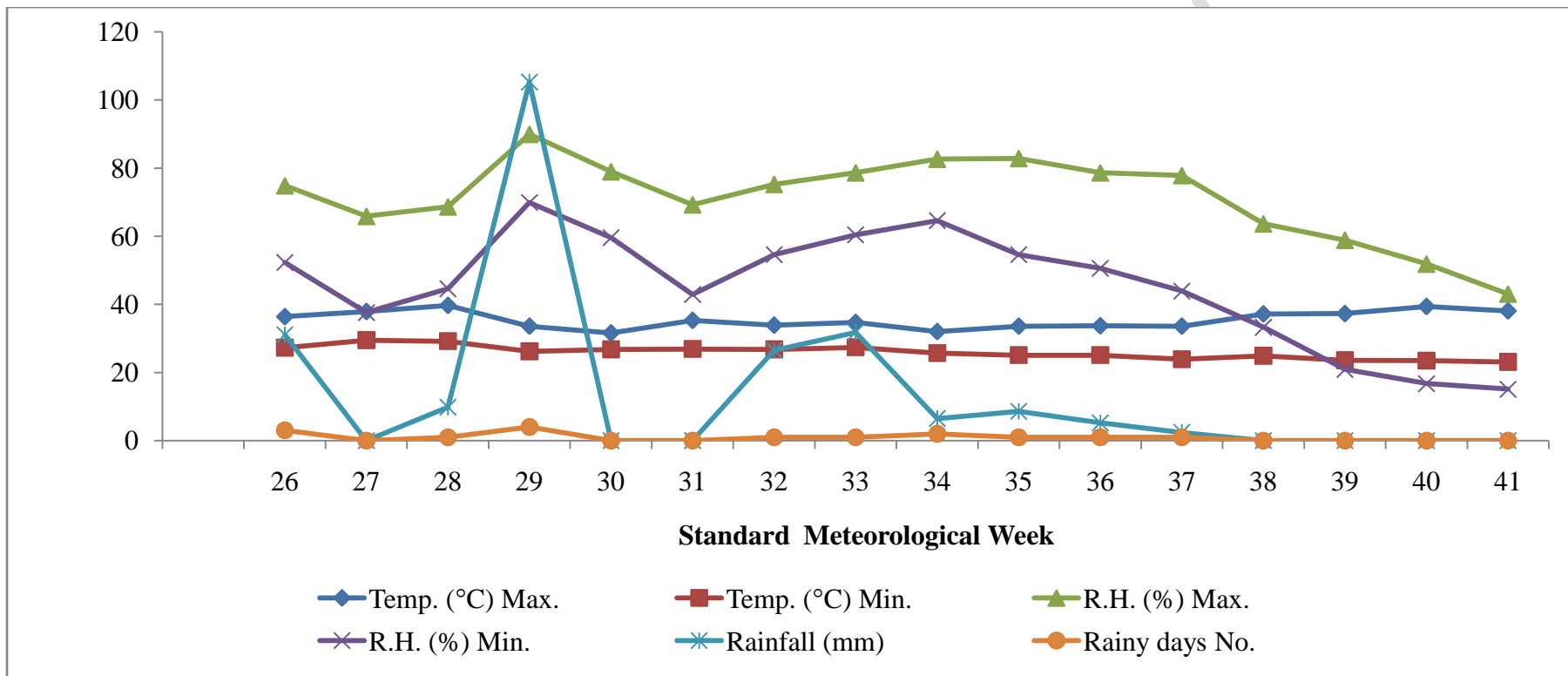


Fig 1: Meteorological data recorded at ARS, Mandor-Jodhpur during crop season

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