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Research Article

EFFECT OF SPACING AND WEED MANAGEMENT ON GROWTH AND YIELD ATTRIBUTES OF SUMMER MOTH BEAN (*VIGNA ACONITIFOLIA*)

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Abstract: A field experiment was conducted at the College Farm, Navsari Agricultural University, Navsari to study during summer 2017. Total eighteen treatment combinations consisting of three row spacing *viz*., S_1: 45 cm between two rows, S_2: 60 cm between two rows and S3: 90 cm between two rows and six weed management practices *viz*., W1: Pendimethalin 750 g/ha as PE, W2: Imazethapyr 75 g/ha as PoE, W3: Quizalofop-p-ethyl 100 g/ha as PoE, W4: One hand weeding at 20 DAS, W5: weed free (two hand weeding 20 and 40 DAS) and W6: unweeded control were evaluated for moth bean crop. Based on field experimentation, it was found that various row spacing and weed management had significant effect on growth and yield attributing characters like, plant height, number of branches per plant, dry matter production per plant and number of pods per plant, which caused significant effect on seed and stover yields of moth bean crop. In case of row spacing, treatment S_3 was found superior than other spacing, but the narrow row spacing S_1 of summer moth bean recorded significantly higher seed and stover yield of moth bean which was at par with treatment S_2. In case of weed management, treatment W5 was found superior than rest of the treatments, but remained at par with treatment W_1.

Keywords: Moth bean, Spacing, Weed management and yield

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Introduction

Moth bean (*Vigna aconitifolia*) is native to India and Pakistan, grown for food production and as a forage and cover crop. It is drought resistant legume, commonly grown in arid and semi-arid regions of India. It is commonly called math, matki, turkish gram or dew bean. Optimum production of moth bean occurs between 24 – 32ºC during the day. Area and production of moth bean has been highest in Rajasthan (98.25% and 97.04%) followed by Gujarat (1.72% and 2.93%). However, Productivity of Rajasthan (274 kg/ha) was below the National average productivity (277 kg/ha). Moth bean is a good source of protein (24%) and are high in dietary fibre. Moth bean also contain essential amino acids particularly lysine and leucine and also certain vitamins. 100 g of raw, uncooked moth bean seeds contain 343 calories, 24 g of protein, 62 g of carbohydrate and 1.6 g of fat. Weeds are an important factor in the management of all land and water resources, but its effect is greatest on agriculture. The losses caused by weeds accounted 45% which is highest than any category of agricultural pest. Weed management is important key factor for enhancing the productivity of moth bean, as weeds compete for nutrients, water, light and space with crop plants throughout the growth period resulting in poor yield of crop. The magnitude of crop yield losses depends on the number of weed flora, period of crop weed competition and its intensity. Thus, it is imperative to eliminate weeds from the crop at proper time and with suitable method. Row spacing is one of the most important factors affecting crop productivity. Optimum plant population and row spacing particularly under dry land conditions is essential to avoid competition for scarce and limited resources. Narrow row spacing may be one of the possible ways of suppressing weeds as the soil surface is covered and consequently leaving a meager chance for weed growth. Spacing plays an important role in contributing to the high yield because thick plant population will not get proper light for photosynthesis and high infestation of diseases. Hence, to evaluate the best weed management practices in context to different row spacing a field trial was undertaken at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari.

Materials and Methods

A field experiment was conducted during summer season of 2017 at College Farm, Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari. The experiment comprised 18 treatments combinations consisting of three rows spacing and six weed management practices were tested by employing factorial randomized block design (FRBD) with three replications. Initial soil of experimental field was clayey in texture, low in Nitrogen (231 kg/ha), medium in available phosphorus (46 kg/ha) and high in available potash (429 kg/ha) and alkaline in reaction (pH 8.14). A basal dose of 20 kg N and 40 kg P2O5 was applied at sowing. Moth bean crop sown on Feb 10, 2017 and variety GMO 1 was used in the study which was released from Main Pulse Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat. It is drought resistant, highly susceptible to yellow mosaic; maturity comes 62-65 days, yield 800-1000 kg/ha.

Results and Discussion

Effect of row spacing on growth and growth attributes

Data on initial and at harvest plant population differed significantly due to various row spacing. It is as certain from the data that the plant population in all the treatments was different which indicates that variation observed in growth and yield attributes was mainly due to plant population. Plant height was found maximum when crop sown at 45 cm between two rows (S_1) and minimum with wider spacing of 90 cm between two rows (S_3). This was apparently because individual plant from the plots with narrow spacing did not get opportunity to proliferate laterally due to the less lateral space. Hence, plants were compelled to

Table-1 *Effect of row spacing and weed management practices on growth and growth attributes of moth bean*

Treatment	Plant population(m^2)		Plant height (cm)	No. of branches per plant	Dry matter production (g) per plant
	20 DAS	At Harvest			
Spacing between two rows (S)					
S_1: 45 cm	29.55	28	27.25	4.65	25.99
S_2: 60 cm	19.33	18.66	26.41	4.97	27.73
S_3: 90 cm	9.61	8.88	23.96	5.23	29.91
S. Em.±	0.2	0.29	0.55	0.1	0.55
C.D. at 5 %	0.59	0.83	1.6	0.3	1.58
Weed management (W)					
W_1: Pendimethalin 750 g/ha as PE	19.88	18.88	26.9	5.05	28.81
W_2: Imazethapyr 75 g/ha as PoE at 20 DAS	19.55	18.55	26.02	4.98	27.95
W_3: Quizalofop-p-ethyl 100 g/ha as PoE at 20 DAS	19.55	18.33	25.5	4.9	26.97
W_4: One HW at 20 DAS	19.22	18.33	24.93	4.81	26.84
W_5: Weed free (two HW 20 and 40DAS)	20	19.44	28.48	5.45	31.01
W_6: Unweeded control	18.77	17.55	23.41	4.52	25.7
S. Em.±	0.29	0.41	0.79	0.15	0.77
C.D. at 5 %	NS	NS	2.27	0.43	2.23
Interaction (S x W)	NS	NS	NS	NS	NS
S. Em.±	0.5	0.71	1.36	0.26	1.34
C.V. %	4.47	6.65	9.16	9.22	8.38

Table-2 *Effect of row spacing and weed management practices on yield and yield attributes of moth bean*

Treatment	No. of pods per plant	No. of seeds per pod	Pod length (cm)	Seed yield (kg/ha)	Stover yield (kg/ha)
Spacing between two rows (S)					
S_1: 45 cm	26.05	5.91	3.75	913	2031
S_2: 60 cm	26.84	6.13	3.89	854	1905
S_3: 90 cm	27.93	6.4	4.04	778	1724
S. Em.±	0.52	0.12	0.08	21	45
C.D. at 5 %	1.49	0.35	NS	61	130
Weed management (W)					
W_1: Pendimethalin 750 g/ha as PE	28.12	6.39	4.09	974	2115
W_2: Imazethapyr 75 g/ha as PoE at 20 DAS	26.76	6.12	3.89	846	1905
W_3: Quizalofop-p-ethyl 100 g/ha as PoE at 20 DAS	26.29	6.11	3.81	788	1800
W_4: One HW at 20 DAS	26.04	6.03	3.71	768	1730
W_5: Weed free (two HW 20 and 40 DAS)	29.78	6.64	4.3	1050	2219
W_6: Unweeded control	24.63	5.59	3.58	664	1551
S. Em.±	0.73	0.17	0.12	30	64
C.D. at 5 %	2.11	0.5	0.35	86	183
Interaction (S x W)	NS	NS	NS	NS	NS
S. Em.±	1.27	0.3	0.21	51	110
C.V. %	8.21	8.59	9.59	10.58	10.14

grow more in upward direction for the fulfilment of light requirement for photosynthesis. This result is accordance with the finding of Insanullah *et al.* (2002) [1] with respect to plant height. In case of number of branches, significantly higher number of branches per plant was observed when crop sown with wider spacing of 90 cm between two rows (S3) as compared to narrow spacing 45 cm between two rows (S_1). This might be due to plants grown with wider spacing got better opportunity of available maximum space, light and nutrients leading to maximum branches per plant. The above finding is in complete agreement with earlier work by Muhammad *et al.* (2012) [2]. In case of dry matter production per plant, in both vegetative as well as reproductive growth was favorably influenced by spacing. Treatment S_3 (90 cm between two rows) produced significantly higher dry weight per plant as compared to S_1 (45 cm between two rows) and S_2 (60 cm between two rows) Thus, sowing of crop with wider spacing S_3 exhibited its superiority by recording maximum number of branches per plant and dry matter production over spacing S_1 and S_2. This might be due to less competition for space, nutrients and moisture which accelerated normal photosynthesis activity and provided sufficient photosynthates for root system. Another reason for that treatment S_1 (45 cm between two rows) was maximum in plant height but due to severe competition for space, the vegetative parts specially checked. Therefore, lower area was not able to synthesize large quantity of synthetase reducing the individual plant performance. The results are in conformation with the findings of Muhammad *et al.* (2012).

Effect of row spacing on yield attributes and yield

Higher number of pods per plant, number of seeds per pod, pod length and test weight were observed in S_3 (90 cm between two rows) as compared to S_1 and S_2, this might be due to less competition for space, moisture and nutrients which accelerate normal photosynthesis activity and more interception of photosynthesis. It produces more photosynthates and maximum dry matter accumulation per plant which ultimately reflected in to better development of yield attributes with this treatment. These findings are sustained with those reported by Muhammad *et al.* (2012), Jakusko *et al.* (2013) [3] with respect to pods per plant and number of seeds per pod. In case of seed and stover yield treatment S_1 (45 cm between two rows) recorded significantly higher seed and stover yields (913 and 2031 kg/ha, respectively) which was statistically at par with treatment S_2 (854 and 1905 kg/ha, respectively). The higher yields in narrow spacing were mainly due to higher number of plants per unit area. It clearly indicated that lower plant population per unit area under wider spacing cannot compensate the reduction in total yield. Similar observations also recorded by Patel *et al.* (2004) [4], Patel *et al.* (2005)[5], Ahmad *et al.* (2010) [6], Patel *et al.* (2010) [7] and Jakusko *et al.* (2013).

Weed Study

Different types of weed flora were observed in experimental field during summer season of 2017. The most common weed species observed on experimental plot were *Echinochloa crus*-galli L. Beauv, *Cynodon dactylon* L. pers, *Sorghum halepense* L. pers, *Alternanthera sessillis* L., *Digera arvensis* Forsk L., *Portulaca oleracea* L. and *Cyperus rotundus* L.

Effect of row spacing on weed parameters

Widely planted moth bean noted significantly higher weed population as well as dry weight of weeds than narrow planted moth bean. This might be due to more space available for weed germination and growth of weed between two rows of crop in wider spacing *i.e.*, S_3 (90 cm between two rows). Further, in narrow spacing (45 cm between two rows), the smothering effect of crop on weeds which led to suppressing effect on weed growth. These results confirmed by Rathi *et al.* (2008) [8].

Effect of weed management practices on weed parameters

All weed management practices significantly reduced the population of weeds compared to unweeded control (T6). Significantly lower weed population and dry weight of weed at all growth stages of moth bean were found under treatment W5 (weed free). This might be due to effective weed control under these treatments in summer moth bean. The results are in close confirmation with the findings of Choudhary *et al.* (2012) [9], Komal *et al.* (2015) [10].

Effect of weed management practices on growth and growth attributes

All the growth parameters like plant height, no of branches per plant and dry matter production were found significant under treatment W5 (weed free), which were under same bar with treatment W1 (Pendimethalin 750 g/ha as PE) during crop growth stages. This might be due to better availability of moisture, nutrient, light and space. The results are in conformity with observations of Komal *et al.* (2015) [10], Chandrakar *et al.* (2014) [11], Choudhary *et al.* (2017) [12].

Effect of weed management practices on yield attributes and yield

Almost all the yield attributing characters [Table-2] *viz*., number of pods per plant, number of seeds per pod and pod length were significantly influenced by various weed management practices. Treatment W5 (weed free) recorded significantly higher number of pods per plant (29.78), seeds per pod (6.64) and pod length (4.30) being at par with treatment W1 (Pendimethalin @ 750 g/ha as PE), while the lowest values of all these characters were noted under W6 (Unweeded control).

Table-3 *Effect of row spacing and weed management practices on total weed population and dry weight of weeds*

Treatment	Total Weed population per m²	Dry weight of weeds (kg/ha)
Spacing between two rows (S)		
S_1: 45 cm	7.84(61.61)	401
S_2: 60 cm	8.15(66.61)	415
S_3: 90 cm	8.38(70.44)	446
S. Em.±	0.09	12.57
C.D. at 5 %	0.26	36.14
Weed management (W)		
W_1: Pendimethalin 750 g/ha as PE	7.75(59.33)	326
W_2: Imazethapyr 75 g/ha as PoE at 20 DAS	7.71(58.55)	305
W_3: Quizalofop-p-ethyl 100 g/ha as PoE at 20 DAS	8.31(68.22)	464
W_4: One HW at 20 DAS	7.78(59.77)	373
W_5: Weed free (two HW 20 and 40 DAS)	7.00(48.33)	257
W_6: Unweeded control	10.19(103.11)	799
S. Em.±	0.13	17.78
C.D. at 5 %	0.37	51.11
Interaction (S x W)	NS	NS
S. Em.±	0.22	30.8
C.V. %	4.85	12.69

Figure in parenthesis refers to original value and outside the parenthesis indicates transformed $\sqrt{x} = 1$*value*

Even through the weed population was higher at later stage of crop under treatment W1 (Pendimethalin @ 750 g/ha as PE) but the significantly lower weed population at initial stage of crop which lead to significant reduction in crop weed competition at the critical growth stage due to effective control of weeds by these treatments reflected in better growth & development of the crop ultimately helped in producing more number of pods per plant, seeds per pod and pod length. The present results are in close association with the findings of Begum and Rao (2006) [13], Tamang *et al.* (2015) [14], Komal *et al.* (2015).

In case of seed and stover yield, significantly higher seed (1050 kg/ha) and stover (2219 kg/ha) yields were recorded under treatment W5 (weed free) being at par with treatment W1 (Pendimethalin @ 750 g/ha as PE). This might be due better growth and development measured in terms of various growth attributing characters such as plant height, number of branches per plant and yield attributing characters like number of pods per plant, number of seeds per pod and pod length. All these parameters showed cumulatively positive and significant influence on seed and stover yields of moth bean. These findings are in close agreement with those reported by Begum and Rao (2006), Kumar *et al.* (2006) [15], Sharma and Yadava (2006) [16], Nandan *et al.* (2011) [17], Choudhary *et al.* (2012), Das (2016) [18].

Conclusion

From the results, it can be concluded that to achieve more profitable yield of summer moth bean, the crop should be sown at S2 (60 cm between two rows) spacing and follow W5 (weed free-two hand weeding at 20 and 40) days after sowing or in case of labour shortage apply pendimethalin @ 750 g/ha as pre emergence.

Application of research: Study of spacing and weed management on growth and yield attributes

Research Category: Agronomy

Abbreviations: DAS- Days After Sowing, PE- Pre Emergence, PoE- Post Emergence, HW- Hand Weeding

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Study area / Sample Collection: College Farm, Navsari

Cultivar / Variety / Breed name: *Vigna aconitifolia*

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
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