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Studies On Effect Of Plant Densities On Growth And Yield Of *Kharif* Mungbean (*Vigna Radiata* L. *Wilczek*)

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ABSTRACT

The experiment was conducted at the Postgraduate student research farm, Department of Agronomy, School of Agriculture, Lovely Professional University, Jalandhar, Punjab, during the kharif season (June-September) of 2015 to find out the impact of plant densities on the relative yield ofkharifmungbean (Vigna radiata (L.) Wilczek). The experiment was laid out in Factorial Randomized Complete Block Design with three replications and constitute of four levels of plant densities viz., 25x10 cm (control), 30x10 cm, 35x10cm and 40x10 cm. Results revealed that most of the growth characters such as plant height, number of branch plant^{-1}, dry weight of leaf, stem, root and total dry weight were significantly increased due to the application of appropriate spacing over control on the similar way application of spacing significantly increased the yield and yield contributing characters also, such as number of pods per plant, pod length, number of seeds per plant, seed index, seed yield, straw yield and harvest index. The highest grain yield (1162.95kg ha^{-1}) was obtained with 30x10cm having an increase of 71.62 % over the control and the lowest with 25x10cm (845.16 kg ha^{-1}).

Key words: *Vigna radiata (L.) Wilczek, Spacing levels, growth and yield characters of mung bean.*

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INTRODUCTION

In India, mung bean is considered to be as the third most vital pulse crop among the Phanerogamae (flowering plants) of the Plantae kingdom after chickpea and pigeon pea. It is a short duration legume crop with wider adaptabilityof 650 genera and about 20,000 species (Doyle, 1994). Therefore, it is an indispensable approach for agriculture scientists to hasten the production aspects of pulses to face the protein requirement of the increasing population of the nation.Spacing or optimum plant density is a pre-requisite for obtaining higher productivity (Rafiei, 2009) because dense plant stand will not afford desired sunlight for the process of photosynthesis and can easily assailed by diseases. Aside from very low, this population will also dwindle the yield (Pookpakdi and Patardilok, 1993). It is an elite prerequisite to perpetuate the optimum plant population by sustaining inter and intra row spacing properly. The maximum plant stand may derogate yield of mungbean causing corporeal development in plants. Hence desired fertilizer dose to decent plant population may increase crop yield of mungbean (Mehmet, 2008) and also affects the plant growth (Jahan and Hamid, 2005) as well as grain yield in mungbean. Plant density may not only be clarified in terms of the number of plants per unit area (plant density) but also in terms of positioning of plants on the ground (spatial arrangement or plant geometry) (Kaul and Singh, 2002).

MATERIALS AND METHODS

The present research work was carried out on an experimental research farm, School of agriculture, Lovely Professional University, Punjab during the term from July to October 2015 in the *kharif* season, to study the impact of phosphorous levels on the yield of *kharif* mung bean. The experimental location was situated geographically at 31022□31.81'N latitude and 75023□03.02 E longitude with an altitude of 252 m above sea level, which falls under the central plain zone of Agra climatic zone of Punjab. Previously soil sample was collected randomly from the experimental site and analyzed for Physio-chemical properties. However, the soil of the experimental site was found to be sandy clay loam and pH of the soil varied from

7.83 to 7.98. The soil of this farm represents the sandy clay loam soil tract of Punjab. The variety SML-668 was used for the present study. The experiment was laid out in randomized block design (RBD) with four plant density levels which replicated thrice. There were a total of 12 unit plots.

The details of different treatments with plant densities are as follows-

T_1: 25×10 cm (5, 00,000 plants ha^{-1})
T_2: 30×10 cm (3, 33,300 plants ha^{-1})
T_3: 35×10 cm (2, 50,000 plants ha^{-1})
T_4: 40×10 cm (2, 22,200 plants ha^{-1})

RESULTS AND DISCUSSION

Effects of phosphorous levels on growth characters of mung bean

i) Plant height: The plant height as influenced by different levels of spacing was recorded in 25, 40 and 55 DAS presented in Table 1. At 25 DAS, maximum plant height (20.68 cm) was recorded with S_3 (35x10 cm) followed by 19.87 cm with S_4 (40x10 cm). S_1 (25x10 cm) recorded the minimum (17.14 cm).At 40 DAS, S_2 (30x10 cm) recorded maximum plant height (37.63 cm) followed by 35.67 cm with S_3 (35x10 cm). S_1 (25x10 cm)recorded the minimum (26.70 cm). S_2 (30x10 cm) recorded maximum plant height at 55 DAS (43.60 cm) followed by 43.09 cm with S_3 (35x10 cm). S_1 (25x10 cm) recorded the minimum (37.97 cm).Maximum plant height was recorded in treatment $T_2$with 30x10 cm followed by T_3 with 35x10 cm. Minimum plant height was recorded in the control plots in which spacing was 25x10 cm applied i.e. T_1. Increased plant height might have been due to the adequate availability of sunlight to each plant required for its growth and development. These findings were in agreement with the results of Jahan and Hamid (2005) reported that decent plant population may increase plant growth.

ii) Number of branches / plant: S2 (30x10 cm) recorded the maximum number of branch $plant^{-1}$(6.22) followed by 5.89 with S3 (35x10 cm) presented in Table 2. The minimum (4.45) was recorded with S1 (25x10 cm). This result was probably due to the differences in spatial performance of mungbean in respect of branches $plant^{-1}$. Because of the dense plant population, plants will not perceive the desired sunlight for the process of photosynthesis and can easily assailed by diseases (Rafiei, 2009).

iii) Dry matter

(a) Root dry weight $plant^{-1}$: At 25 DAS, S2 (30x10 cm) recorded maximum root dry weight (0.34 g) followed by 0.33 g with S3 (35x10 cm). The minimum (0.19 g) was found with S1 (25x10 cm). At 40 DAS, S3 (35x10 cm) recorded maximum root dry weight (0.44 g) followed by0.43 g with S2 (30x10 cm). S1 (25x10 cm) recorded the minimum (0.38 g). At 55 DAS, S4 (40x10 cm) recorded maximum root dry weight (0.55 g) followed by 0.54 g with S3 (35x10 cm). S1 (25x10 cm) recorded the minimum (0.52 g) presented in Table 3(a).Better photosynthetic activity due to greater exposure to light and increased availability of nutrients to plants might have also resulted in higher root dry weight of the plant. Results reported by Erman *et. al*. (2009) and Neelamegam (2011) are more or less similar to these findings. Pandya *et. al*. (2009) also reported similar results in cowpea.

(b) Leaf dry weight $plant^{-1}$: At 25 DAS, S3 (35x10 cm) recorded maximum leaf dry weight (0.66 g) followed by 0.63 g with S2 (30x10 cm). The minimum (0.57 g) was found with S1 (25x10 cm). At 40 DAS, S3 (35x10 cm) recorded maximum root dry weight (0.75 g) followed by 0.75 g with S1 (25x10 cm). S2 (30x10 cm) recorded the minimum (0.72 g). At 55 DASS2 (30x10 cm) recorded maximum leaf dry weight (0.81 g) followed by 0.75 g with S4 (40x10 cm). S3 (35x10 cm) recorded the minimum (0.73 g) presented in Table 3(b). Results reported by Erman *et. al*. (2009) and Neelamegam (2011) are more or less similar to these findings. Pandya *et. al*. (2009) also reported similar results in cowpea.

(c) Total dry weight/plant : S_2 (30x10 cm) recorded maximum dry weight of plant (1.39 g) followed by 1.37 g with S_3 (35x10 cm). S1 (25x10 cm) recorded the minimum dry weight (12.9 g) presented in Table 3(c). The above results were supported by Raundal et al (1990), who reported that application of phosphorous 45 kg ha^{-1} to mungbean grown in kharif season significantly increased the dry matter production.

Effect of spacing levels on yield and yield attributes of mung bean

i) Number of pods $plant^{-1}$: According to the data presented in Table 4(a), at harvest S2 (30x10 cm) recorded the maximum number of pods plant-1 (28.72) followed by 26.29 with S3 (35x10 cm). The minimum (19.66) was recorded with S1 (25x10 cm). Higher number of pods plant-1 might have been possible due to more vigour and strength attained by the plants as a result of better photosynthetic activities with sufficient availability of light, spacing between the plants and supply of nutrients in balanced quantity of the plants at growing stages.(Rafiei, 2009).

ii) Pod Length: According to the data presented in Table 4(b), S_2 (30x10 cm) recorded maximum length of the pod (8.18 cm) followed by 7.79 cm with S_3 (35x10 cm). S1 (25x10 cm) recorded the minimum (5.58 cm). Higher vigour index and plant growth attained by the plants treated with different combinations of phosphorus 30x10 cm resulted into a higher length of pod. Results reported by Nadeem *et. al.* (2003) and Prasad *et. al.* (2005) is in conformity with these findings.

iii) Number of seeds plant^{-1}: According to the data presented in Table 4(c),S2 (30x10 cm) recorded the maximum number of seeds pod-1 (282.14) followed by 252.43 with S3 (35x10 cm). The minimum (123.84) remained with S1 (25x10 cm). Sufficient availability of nutrients (nitrogen, phosphorus, potassium and spacing) and their absorption by the plants, together with better photosynthetic activity due to proper light and spacing between the plants increased the vigour and plant growth thereby resulting in greater number of seeds plant^{-1}. These findings are similar to the results reported by Meena *et. al.* (2002), Bhattarai *et. al.* (2003), Nadeem *et. al.* (2003), Sundara *et. al.* (2004), Prasad *et. al.* (2005) and Swapna *et. al.*(2012).

iv) 1000 seed weight: S2 (30x10 cm) recorded maximum test weight (49.10 g) followed by 44.46 g with S3 (35x10 cm).The minimum (36.23 g) remained with S1 (25x10 cm). Higher vigour and growth attained by the plants due to sufficient absorption of nutrients might have resulted in higher test weight. Results reported by Singh and Agarwal (2001), Meena *et. al.* (2001), Aga *et. al.* (2004), Muhammad *et. al.* (2004), Sundara *et. al.* (2004), Prasad *et. al.* (2005), Kumar *et. al.* (2006), Kulligod *et. al.* (2012) are almost in conformity with these findings.

v) Grain yield : Data presented in Table 4(e),S_2 (30x10 cm) recorded maximum grain yield (1162.95 Kg ha^{-1}) followed by 980.41 Kg ha^{-1}with S1 (25x10 cm). The minimum (845.16 Kg ha^{-1}) remained with S4 (40x10 cm).Grain yield gradually increased with the increase in the levels of phosphorus and spacing as compared to control.Neelamegam (2011) (Greengram) Kulligod *et. al.* (Greengram)and Yadav *et al.* (2007) also reported similar results.

vi) Straw yield : According to the data presented in Table 4(f),S2 (30x10 cm) recorded maximum fodder yield (1791.94 Kg ha^{-1}) followed by 1732.82 Kg ha^{-1} with S1 (25x10 cm). The minimum (1611.19 Kg ha^{-1}) remained with S4 (30x10 cm). Results reported by Meena *et. al.* (2002), Aga *et. al.* (2004) and Jat *et. al.* (2012) is more or less similar to these findings.

vii) Harvest index : According to the data presented in Table 4(g),Spacingshow significant influences on the harvest index While maximum was recorded (41.57) when S_2 – 30x10cmwas applied, and minimum with S_4 -40x10cm (33.78) with control.

Table 1. Impact of different spacing levels on plant height at different days after sowing.

Treatments	Plant Height(cm)		
	25 DAS	40 DAS	55 DAS
S_1	17.196	26.705	37.972
S_2	18.880	37.631	43.605
S_3	20.685	35.673	43.099
S_4	19.878	32.873	41.460
SEm±	0.059	0.105	0.493
CD(P=0.05)	0.182	0.267	0.583
CD (P=0.01)	0.254	0.358	0.799

Table 2. Impact of different spacing levels on number of branches plant^{-1}

Treatments	Number of Branches/Plant	% Increase in Number of Branches Over Control
S_1	4.453	13.92
S_2	6.221	38.38
S_3	5.898	35.01
S_4	5.125	25.20
SEm±	0.035	
CD(P=0.05)	0.147	
CD(P=0.01)	0.192	

Table 3(a). Impact of different spacing levels on root dry weight at 25, 40 and 55 DAS

Treatments	Root dry weight (g)		
	25DAS	40DAS	55DAS
S_1	0.195	0.382	0.525
S_2	0.349	0.437	0.547
S_3	0.333	0.449	0.549
S_4	0.272	0.388	0.556
SEm±	0.001	0.002	0.003
CD(P=0.05)	0.011	0.015	0.012
CD (P=0.01)	0.010	0.018	0.024

Table 3(b). Impact of different spacing levels on leaf dry weight at different days after sowing

Treatments	Leaf dry weight (g)		
	25DAS	40DAS	55DAS
S_1	0.571	0.750	0.752
S_2	0.638	0.721	0.813
S_3	0.667	0.757	0.734
S_4	0.634	0.723	0.752
SEm±	0.002	4.773	0.017
CD(P=0.05)	0.018	0.007	0.104
CD (P=0.01)	0.013	0.007	0.146

Table 3(c). Impact of different spacing levels of total dry weight at different days after sowing

Plant Densities	Total dry weight (g)		
	25DAS	40DAS	55DAS
S1	1.293	1.741	2.096
S2	1.395	1.910	2.241
S3	1.378	1.852	2.206
S4	1.375	1.848	2.264
SEm±	0.002	0.004	8.365
CD (P=0.05)	0.013	0.012	0.006
CD (P=0.01)	0.013	0.022	0.012

Table 4(a). Impact of different spacing levels on Number of pods per plant at harvest

Treatments	Number of Pods/Plant	% Increase in Number of Pods Over Control
S_1	19.666	38.13
S_2	28.721	34.13
S_3	26.296	28.06
S_4	24.185	21.78
CD(P=0.05)	1.311	
CD (P=0.01)	1.777	

CONCLUSIONS

Observations were recorded on growth parameters like plant height, number of branches per plant, root dry weight, leaf dry weight, stem dry weight and total dry weight of the plant and yield attributes viz., number of pods per plant, pod length, seed yield, straw yield, seed index, number of seeds per plant. Data was also harvest index, percentage increase over control and benefit cost ratio for different treatments. All the above mentioned parameters of green gram were influenced by graded levels of spacing. In view of the findings and the results presented, it may be concluded that among the four spacing levels, S_2 (30x10cm) significantly dominated others. Of the four treatments, S_2 (30x10cm) emerged as the best interaction for growth, yield for cultivation of mungbean to suit to the environmental conditions of the Punjab region. However, since this is based on one year experiment, further trails may be needed to substantiate the results.

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