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Effect of different cultivars and row spacing on growth and yield of moong bean (*Vigna radiata* L)

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Abstract
The present investigation entitled" Effect of Different Cultivars and Row Spacing on Growth and Yield of Moong bean (*Vigna radiata* L.) was carried out at Crop Research Farm of National Post Graduate College, Barhalganj, Gorakhpur, (U P.) during zaid season on 2021 with the objective to study the effect of different cultivars and row spacing for assessing the effect of cultivars and row spacing on growth, yield and quality of Moong bean (*Vigna radiata* L.). The soil of the experimental field was silty loam in texture with low, medium and high in N, P, and K, respectively. The experimental site is situated in sub-tropical zone in Indo gangetic plains.

The experiment was laid out in Randomized Block Design with 9 treatment combinations and 3 replications. Moong bean was sown on 15th March 2021 with treatment combinations *viz*. T_1-SML668+20 cm, T_2-SML668+30 cm, T_3-SML+40 cm, T_4-Virat+20 cm, T_5-Virat+30 cm, T_6-Virat+40 cm, T_7-Shweta+20 cm, T_8-Shweta+30 cm and T_9-Shweta+40 cm, respectively. The crop was harvested on 25th May 2021. The result indicated that the treatment combination T_8-Shweta along with row spacing at 30 cm was significantly superior in terms of plant height, number of branches per plant, number of pods per plant, yield, stover yield, protein content, gross return (Rs/ha), net return (Rs/ha) and B:C ratio (%) over rest of the treatment.

Keywords: Moong bean, cultivars, row spacing, yield attributing parameters, yield, stover yield, protein content

Introduction
Pulses are important not only for their value as human food but also because of high proteins content for livestock. It has been important component of Indian agriculture enabling the land to restore fertility by fixing atmospheric nitrogen, so as to produce reasonable yields of succeeding crops and to meet out the demand of dietary requirements regarding protein, carbohydrates and other natural sources. (Tejada *et al*. 2009) [8]. On an average, pulses contain 22-24% protein as against 8-10% in cereals. A good amount of lysine is present in the pulses.

Moong bean (*Vigna radiata* L.) is an important grain legume of arid and semi-arid regions that belongs to family Fabaceae. It is originated from India and spread in South East Asia (China) and some areas to Africa. It is warm season annual grain legumes and the optimum temperature ranges from 27 °C to 30 °C. Rapid growth and early maturing characteristics and ability to restore the soil fertility by adding 20-25 kg N per ha. Makes it a valuable crop in various cropping system. Anjum *et al*. (2006) [2]. It is grown under wide range of soil conditions including marginal lands but perform best on fertile soil. Being a short duration crop and having wider adoptability, it can be grown in summer as well as in kharif season also. The yield of summer green gram is comparatively more than that of kharif crop, mainly due to controlled moisture conditions through irrigation, abundant sunshine and less pest and diseases infection. The green gram foliage left over after picking mature pods can either be fed to livestock or it may plough in situ as green manure to enrich soil with organic matter.

In India, it is occupied an area of 3.24 m.ha., having total production of 1.39 m tons of grain with productivity of 346 kg per ha. In India major green gram producing states are Odisha, Madhya Pradesh, Rajasthan, Maharashtra, Gujarat and Bihar.

Moong bean (*Vigna radiata* L.) gives low seed yield and poor growth performance mainly due to poor agronomic management. Among the different agronomic practices, cultivars and optimum plant population is a prerequisite for obtaining higher productivity. So, the present studies were conducted to find out high yielding cultivars and suitable spacing for maximizing yield of Moong bean in eastern U.P.

Material and Methods

The field experiment was carried out at the Crop Research Farm of National Post Graduate College, Barhalganj, Gorakhpur, U.P. during Zaid season 2021. The experimental site is situated in subtropical zone in Indo-gangetic plains and lies between 260471 North latitude, 820101 East longitude and 1130 m above sea level. The soil of the experimental field was silty loam in texture and slightly alkaline in reaction with PH 7.6, EC 0.20 dsm-1, organic carbon 0.40% and available Nitrogen 196 kg ha-1, Phosphorus 18.9 kg ha-1 and Potassium 260.50 kg ha-1 at 0-15 cm soil depth. The experiment was laid out in Randomized Block Design, keeping 9 treatment combinations *viz* T_1-SML 668+20 cm, T_2-SML 668+30 cm, T_3-SML 668+40 cm, T_4-Virat+20 cm, T_5-Virat+30 cm, T_6-Virat+40 cm, T_7-Shweta+20 cm, T_8-Shweta+30 cm and T_9-Shweta+40 cm, respectively with 3 replications. The sowing was done on the 15th March 2021. The crop was sown by using seed rate of 25 kg per ha. and Nitrogen, Phosphorus and Potash were applied to the crops as per recombination of the crops. The other agronomical cultural practices such as manuring, irrigation, weeding and plant protection measures have been performed as per requisite. The crop was harvested manually at the maturity dated on 25th May 2021 and grain and straw were recorded.

Result and Discussion

Growth Parameters

As experiment was conducted to observe the influence of various cultivars and row spacing on growth and yield of Moong bean. The data pertaining to growth, yield and quality along with statistical interpretations are presented and discussed.

Different cultivars of Moong bean and row spacing had a significant effect on growth characters *viz*. plant height, number of branches plant-1 and number of leaves plant-1 during the year of study given in Table 1 clearly indicates that the maximum number of branches plant-1 and number of leaves plant-1 (12.14 and 13.83 respectively) were recorded with the Treatment T_8 i.e. cultivars Shweta along with row spacing at 30 cm, except plant height which was recorded maximum (58 cm) with the Treatment T_7 i.e. Cultivar Shweta along with row spacing at 20 cm., while the lowest values were observed (plant height 45 cm, number of branchesplant-1 6.50 and number of leavesplant-18.00, respectively) with the Treatment T 3 I.e. cultivars SML 668 along with row spacing at 40 cm. Environmental factors and genetic characteristics of plants play an important role in determining plant height. The maximum plant height was because of plant enjoying the full benefit of available resources and sunlight as compared to dense population, due to this, vertical growth is more as compared to horizontal growth. Similar results were reported by Maqsood *et al*. (1999) [6] and Thavaprakash (2017) [9]. The number of branches per plant was affected significantly due to plants present at higher densities accumulate less carbon, which is not sufficient to more branching. Similar observation has been recorded by Gama *et al*. (2007) [4].

Table 1: Growth attributes of Moong bean as affected by cultivars and row spacing

Treatment	Plant Height (cm)	No. of Branches plant-1	No of leaves plant-1
T_1	50.00	8.20	12.50
T_2	46.00	7.00	8.80
T_3	45.00	6.50	8.00
T_4	52.42	8.20	10.20
T_5	54.00	11.01	13.66
T_6	51.00	10.57	13.60
T_7	58.00	8.40	10.60
T_8	56.00	12.14	13.83
T_9	50.00	11.54	13.68
S.Em	0.82	0.19	0.09
CD at 5%	2.46	0.57	0.28

Yield Parameters

Number of pods plant-1, yield, stover yield and protein content as influenced by cultivars and row spacing have been shown in Table 2 clearly indicates that number of pods plant-1, length of pod, yield, stover yield and protein content (56, 7.50 cm, 17.53 q ha-1, 49.71q ha-1, and
24.74%, respectively) were recorded highest with the Treatment T_8 i.e. Cultivar Shweta along with row spacing at 30 cm., while the lowest values were observed (40.00, 6.00 cm, 11.40 q ha-1, 31.45 q ha-1and 24.40%, respectively) with the Treatment T_1 i.e. cultivars SML 668 along with row spacing at 20 cm. Effect of cultivars and row spacing on number of pods per plant was found significant. It might be due to greater number of rows and greater number of plants, which might have adversely affected the pod development. Similar results have been reported by Mallik *et al*. (2012). The significant difference was recorded in seed yield as well as stover yield due to cultivars and row spacing arrangement. Chaudhary *et al*. (2017) [3] stated that optimum row spacing plays an important role in contributing to the high yield and stover yield, because thick plant population would not get sufficient light for photosynthesis and can be easily attack by diseases. These findings are quite in line with the findings of Abbas (2000) [1] and Sharma *et al*. (2000) [7].

Table 2: Yield attributes and yield of Moong bean as affected by cultivars and row spacing

Treatment	Number of Pod plant-1	Length of pod (cm)	yield (qha-1)	Stover yield (q ha-1)	Protein content (%)
T_1	40.00	6.00	11.40	31.45	24.40
T_2	44.80	6.40	13.20	36.62	24.50
T_3	46.15	6.60	14.50	39.60	24.60
T_4	45.00	6.50	15.00	40.76	24.50
T_5	48.00	7.18	15.77	41.97	24.58
T_6	52.00	6.90	13.20	36.25	24.69
T_7	48.00	6.30	12.80	35.35	24.53
T_8	56.00	7.50	17.53	49.71	24.74
T_9	52.00	7.20	17.30	47.25	24.70
S.Em	1.18	0.06	0.33	1.30	-
CD. (at 5%)	3.54	0.19	0.99	3.91	-

Economic Feasibility

To examine the economic feasibility and viability of different treatments under investigation, economics of Moong bean production in terms of gross return (Rs per ha), net return (Rs per ha) and B C ratio were calculated for different treatments and the outcome is presented in Table 3.

It is obvious from the fallowing Table that the Treatment T 8 i.e., cultivar Sweta along with row spacing at 30 cm. registered highest gross return (Rs 87,650), net return (Rs 60,850) and benefit cost ratio (2.27) per ha., this might be due to higher yield in the treatment compared to other treatments.

Table 3: Gross return, net return and benefit: cost ratio of Moong bean as affected by cultivars and row spacing

Treatments	Gross return (₹ha-1)	Net Return (₹ha 1)	B:C ratio
T_1	57000	31323	1.21
T_2	66000	40908	1.63
T_3	72500	47218	1.86
T_4	75000	48392	1.81
T_5	78850	52732	2.01
T_6	66000	39702	1.50
T_7	64000	37005	1.37
T_8	87650	60850	2.27
T_9	86500	59783	1.72

Conclusion

Based on the experimental findings, it may be concluded that variety Shweta along with row spacing at 30 cm. has been proved to be an ideal to exploit the maximum yield.

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