Original Research Article

EFFECT OF VARIETIES AND SPACING ON GROWTH AND YIELD OF GREEN GRAM (*VIGNA RADIATA* L.)

ABSTRACT

Aim : This research was conducted to evaluate the effect of varieties and spacing on growth and yield of green gram (*Vigna radiate L.*)

Study Design : Split Plot Design

Place and Duration of Study : The experiment was conducted during kharif season of 2021 at G.H. Raisoni University Student Research Farm, Saikheda.

Methodology : The experiment consisted of three main treatments of varieties Kopargaon(V_1), Sindhu (NVL-605)(V_2) and PDM-139 (Samrat)(V_3) and four sub treatments of spacing 30 cm x 10 cm(S_1), 30 cm x 15 cm(S_2),45 cm x 10 cm(S_3) and 45 cm x 15 cm(S_4) were evaluated~~. The Significantly higher maximum~~ Observations included number of branches per plant, ~~number of~~ leaves per plant, ~~number of~~ pods per plant, pod length, number of grains per pod, test weight, seed and stover yield per hectare and protein content.

Result : ~~maximum~~ Higher number of branches per plant (8.60), ~~number of~~ leaves per plant (21.00), ~~number of~~ pods per plant (15.53), pod length (8.55 cm), number of grains per pod (9.80), test weight (37.66 g), seed (9.06q/ha) and stover yield (18.49q/ha), protein content (22.78%) were recorded with variety PDM-139 (Samrat) sown by adopting spacing of 30 cm x 10 cm.

Conclusion : ~~Showed that~~ Green gram variety PDM-139 (Samrat) ~~when~~ sown ~~with~~ spacing ~~level~~ of 30 cm x 10 cm recorded ~~the maximum and~~ significantly higher ~~values of~~ growth parameters, yield parameters and yield.

Keywords: Green gram, varieties, spacing, growth parameters, yield attributes and yield

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INTRODUCTION

Green gram (*Vigna radiata* L.) is an important pulse crops ~~in~~ of ~~our~~ country after chickpea and pigeon pea. It is ~~important~~ short duration grain legume crop with wide adaptability, low input requirement and has the ability to improve soil fertility by fixing atmospheric nitrogen ~~by adding~~ and adds 20-25 kg N /ha and well suited to small holder production under adverse climatic conditions (Vijayalakshmi and Bhattacharya, 2006). Green gram is grown on about 3.70 million hectares with annual production of 1.57 million tons. India is the largest producer of green gram and account for 54% of the world production and covers 65% of the world acreage. During 2017-2018, 1.9 MT of mung bean was produced from 4.07 M ha area (DES, 2018) distributed over different seasons. While Madhya Pradesh contributes 5.47 per cent of total mung bean area in India *i.e.*, 2.97 lakh hectare area with 2.20 lakh tons of production which contributes 11.57 per cent of total mung bean production in India in 2017-18 ~~(Anonymous, 2018).~~

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It is a drought resistant crop and suitable for Dryland farming and predominantly used as an intercrop with other crops. ~~It is an important grain legume of the country, has wider adaptability throughout the year and is growing during Kharif & Zaid in north India and Rabi season in south India.~~

In order to fulfil the requirement of country sometimes import of pulses is the usual process of food seed trade of India. A number of high yielding varieties have been developed at different research station of the state. These varieties yield two to three times more than the older varieties ~~These varieties also~~ and differ in their yielding potential under different climate and edaphic conditions Different varieties of green gram have varying nutrient demand and climatic adaptability. Therefore, selection of appropriate adoptable variety requires immediate and large efforts in the direction ~~of an improved varieties~~ of testing adaptable variety for a particular tract and ~~its~~ distribution.

~~In production of green gram,~~ It is more desirable and essential to achieve simultaneously the twin objective of maximum yield as well as best quality seed in any crop. This could be achieved by providing the most optimum plant population per unit area and balanced nutrient ~~under field conditions which could be provided by optimizing the spacing and fertilizer levels~~. ~~It is essential to provide optimum plant population density per unit area by adjusting the spacing levels in green gram~~. Unlike the normal spacing, the plants grown in closer spacing exhibit more

vertical growth, but tend to give less yield and poor- quality seeds due to stiff competition for space, light, nutrient and moisture in view of heavier plant population pressure (Dhanraj *et al*.,2001). ~~Keeping these points in view~~

MATERIALS AND METHODS

The present investigation was under taken at the Student instructional field, department of Agronomy, School of Agricultural sciences, G. H. Raisoni University, Saunsar, Distt-Chhindwara (M.P.) during *kharif* season of year 2020~~–21~~. A set of 12 treatment combinations including three green gram varieties were taken under main plot treatments *viz*., Kopargaon (V_1), Sindhu (NVL-605) (V_2) and PDM-139 (Samrat) (V_3) and four spacing levels as sub plot treatment *viz.*, 30 cm x 10 cm (S_1), 30 cm x 15 cm (S_2), 45 cm x 10 cm (S_3) and 45 cm x 15 cm (S_4) ~~were evaluated~~ laid out in Split plot design and replicated thrice. Full recommended dose of nitrogen, phosphorus and potassium at the rate of 25 kg N, 50 kg P_2O_5 and 40 kg K_2O /ha, respectively was uniformly applied to each plot as basal dose before sowing~~. Each fertilizer i. e. nitrogen, phosphorus and potassium were applied in each plot as basal at the time of sowing as 100 % fertility levels.~~ Fertilizers were applied by placement i.e., 5 cm away from seed row and of 5 cm below the seed zone. All other agronomic practices were ~~applied uniformly~~ carried uniformly in all treatment plots

RESULTS AND DISCUSSION

GROWTH PARAMETERS

Number of branches as well as leaves per plant are important growth parameters contributing to seed yield of any crop. Number of leaves and branches per plant represents index of growth and development indicating the infrastructure build-up of plants.

It is evident from the data (Table- 1) that number of leaves as well as branches per plant varied significantly among different varieties. Among different varieties, PDM-139 (Samrat) produced significantly higher number of branches as well as leaves per plant (7.12 and 17.85). Among the spacins testedg, crop sown at 30 cm x 10 cm, produced significantly higher number of branches and leaves per plant (7.07 and 17.47).

Interaction between green gram varieties and spacing levels, revealed that green gram variety PDM-139 (Samrat) sown at spacing level of 30 cm x 10 cm produced significantly higher number of branches as well as leaves per plant (8.60 and 21.00).

Performance of a crop with respect to growth, yield and quality are highly influenced by various factors like genetic constitution of variety, micro-climate of the area and crop management. The wide variation in growth parameters of the genotypes might be due to their genetic makeup, which indirectly govern the morphology of the plant. Since all the varieties were grown under the same climatic conditions. Similar results were reported by Tripathi *et al*. (2012), Akhila *et al*., (2017) and Govardhan *et al*. (2017). The differences among the varieties with respect to number of branches may be due to inheritance of genetic divergence of the varieties. The present findings are in line with Verma *et al*. (2011~~). Further, the differential behaviour among the varieties could be explained by the variation in their genetic makeup and their differential behavior under different climatic conditions. Govardhan *et al*. (2017) at different locations also obtained similar variation in green gram varieties in terms of plant height, number of branching dry matter accumulation and nodules.~~

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Among the spacings tested, higher number of branches and leaves per plant were recorded at 30 cm × 10 cm over other spacings. It may be ascribed to the better growth of plants under this spacing and exhibited better vegetative growth due to higher plant population density and competition which resulted in higher horizontal growth and plant canopy area compared to other spacings. Similar results were reported by Satodiya *et al*., (2015).

YIELD ATTRIBUTES AND YIELD

It is evident from the data that number of number of pods per plant, pod length, number of grains per pod, test weight, seed and stover yield per hectare (Table- 1) increased successively under different treatments. Among different varieties, PDM-139 (Samrat) produced significantly higher number of pods per plant, pod length, number of grains per pod, test weight, seed and stover yield per hectare (13.03, 6.57 cm, 8.05, 34.44 g, 7.67 and 17.08q/ha, respectively) over rest of the treatments. Among the spacings, crop sown at 30 cm x 10 cm spacing, produced significantly number of pods per plant, pod length, number of grains per pod, test weight, seed and stover yield per hectare (12.91, 6.29 cm, 7.64, 34.03 g, 7.46 and 17.14q/ha, respectively).

Interaction between green gram varieties and spacings revealed that variety PDM-139 (Samrat) sown at spacing of 30 cm x 10 cm produced significantly higher number of pods per plant, pod length, number of grains per pod, test weight, seed and stover yield per hectare (15.53, 8.55 cm, 9.80, 37.66 g, 9.06 and 18.49 q/ha, respectively).

Varieties registered significant differences for various yield attributes. Number of pods per plant, length of pod, number of grains per pod, test weight, seed yield, straw yield and harvest index were higher with green gram variety PDM-139 (Samrat) due to higher number of branches which in turn has resulted in maximum number of pods per plant, pod length, and test weight as compared to all other varieties tested. Higher vegetative growth especially more number of branches helped in synthesis of greater amount of food material which might have increased yield attributes. Similar results werev reported by Mondal and Sengupta (2019) These results are in close conformity with the findings of Akhila*et al*., (2017), Dash and Rautary (2017) and Mondal and Sengupta (2019).

Increase in grain yield may be due to increase in the number of leaves which worked as an efficient photosynthesis structure and produced high amount of carbohydrates in the plant system. More number of branches which borne more number of flowers, which resulted higher fruits/plant and fruit yield and their attributes. Similar findings were also reported by Kudi*et al*. (2017) and Narendra *et al*., (2019).

Maximum yield attributes and yield and were registered at spacing of 30 cm × 10 cm. which may be attributed to better growth and development of crop plants under less plant density which lead to better source to sink relationship due to availability of balanced and adequate nutrients, better light, space and moisture unlike in narrow spacing. Lower growth and yield under narrow spacings may be due to accommodation of more plant population per unit area. Similar results were also reported by Tiwari *et al*., (2016), Ravi*et al*., (2018) and Veeramani, (2019).

PROTEIN CONTENT

Among different varieties tested, PDM-139 (Samrat) produced significantly highest protein content (22.38%). Among the spacings, crop sown at 30 cm x 10 cm spacing, produced significantly highest protein content (22.10%). The protein content varied significantly with

different plant spacings. Maximum protein content was registered with plant spacing of 30 cm x 10 cm. Similar results were also reported by Kumar et al. (2015).

Interaction between green gram varieties and spacing levels, revealed that variety PDM-139 (Samrat) sown at spacing level of 30 cm x 10 cm produced significantly highest protein Protein content is a resultant of N content and uptake. The results of the present investigation regarding differential behaviour of green gram varieties with respect to nutrient concentration, their uptake and protein content are in close conformity with findings of other workers like Dash and Bherva (2018) and Patidar and Singh (2018).

CONCLUSION

From the results, it was highlighted that under agro-climatic conditions of Chhindwara (M.P.), sowing of green gram variety PDM-139 (Samrat) at spacing of 30 cm x 10 cm was found to be the best for achieving higher growth parameters, yield attributes and seed yield. ~~growth and yield attributing characters as well as seed yield.~~

REFERENCES

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Akhila, K., Kaswala, A.R., Priyanka and Dubey, P.K. 2017. Effect of liquid fertilizers on growth yield and economics of the green gram (*Vigna radiata*) crop under organic farming. *International Journal of Chemical Studies*, 5 (6): 809-812.

Anonymous, 2018. Ministry of Agriculture & FW (DAC&FW), GOI. Pulses Revolution - From Food to Nutritional Security. 2017-18, Pp. 1-115.

Dash. M. and Bherva. B 2018. Effect of different date of sowing and weed management on nutrient uptake and economic of summer mung bean varieties. *Journal of Pharmacognosy and Phytochemistry*, SPI: 1682-1685.

Dash. S.R. and Rautarary. B.L. 2017. Growth parameter and yield of green gram varieties in east and south east coastal plain of Odisha. India. *Journal of Current Microbiology and Applied Sciences*, 6 (10): 1517-1523.

DES,2018.https://eands.dacnet.nic.in/PDF/Agricultural%20Statistics%20at%20a%20Glance%202018.pdf.

Dhanraj, R., Om Prakash and Ahlawat, I. P. S. 2001. Response of French bean (*Phesolus vulgaris*) varieties to plant density and nitrogen application. Indian Journal Agronomy, 46: 277- 281.

Govardhan. G Reddy. K.H P Reddy. D M. 2017. Physiological response of mung bean genotype to irrigated and moisture stress condition. *Journal of Ecology, Environment and Conservation*, 23 (1): 259-264.

Mondal, R. and Sengupta, K. 2019. Study on the performance of mung bean varieties in the New Alluvial Zone of West Bengal. *Journal of Crop and Weed*, 15 (1): 186-191.

Patidar Ketan and Singh, T. 2018. Effect of varieties and dates of sowing on growth, yield and quality of black gram (*Vigna mungo* L.). *Annals of Plant and Soil Research*, 20 (4): 428-431.

Ravi Kumar, Tomar, G. S., Narendra Kumawat and Shishu Pal Singh, 2018. Effect of varieties, plant density and molybdenum on yield and economics of black gram under rainfed condition of Chhattisgarh. *International Journal of Chemical Studies*, 6 (1): 1867-1870.

Satodiya, B.N., Patel, H.C. and Soni, N.V. (2015). Effect of planting density and integrated nutrient management on flowering, growth and yield of vegetable cowpea [*Vigna unguiculata* (L) Walp]. *Asian J. Hort.* 10: 232- 236.

Tiwari, D., Upadhyay, S. and Paliwal, A. (2016). Plant spacing response on growth and yield of fenugreek in high altitude of Uttarakhand. *International Journal of New Technology and Research*, 2 (10): 33- 35.

Tripathi, P. K., Singh, M. K. Singh, J. P. and Singh, O. N. 2012. Effect of rhizobial strains and sulphur nutrition on mung bean [*Vigna radiata* (L.) wilczek] cultivars under dryland agro-ecosystem of Indo-Gangetic plain. *African Journal of Agriculture Research*. 7 (1): 34-42.

Veeramani, P. 2019. Effect of Plant Spacing on the Growth and Yield of Black gram (*Vigna mungo*). *J. Krishi Vigyan*, 8 (1): 101-104.

Verma. C.K., Yadav. D. and Singh. V. 2011 Effect of yield and quality of green gram varieties by foliar spray of urea and seed rate Plant Archives, 11 (1): 289-291.

Vijayalakshmi and Bhattacharya, A. (2006). Mung bean grain yield, effect of phenology, growth parameters and total degree-days during different crop growth durations. *Legume Research*. 29 (2): 79- 88.

TABLE 1: EFFECT OF DIFFERENT VARIETIES AND SPACINGS ON GROWTH AND YIELD OF GREEN GRAM

Treatment	Number of branches per plant	Number of leaves/ plant	number of pods per plant	Pod length (cm)	Number of grains per pod	Test weight (g)	Seed yield (q/ha)	Stover yield (q/ha)	Protein content (%)
	Effect of varieties								
V_1	6.42	15.58	11.52	5.36	6.85	32.56	5.54	15.40	21.87
V_2	5.45	11.84	8.90	3.74	5.07	28.27	4.91	14.00	19.68
V_3	7.12	17.85	13.03	6.57	8.05	34.44	7.67	17.08	22.38
S. Em±	0.21	0.29	0.32	0.20	0.24	0.24	0.09	0.22	0.15
C. D.	0.83	1.16	1.28	0.81	0.97	0.96	0.40	0.89	0.61
	Effect of spacing								
S_1	7.07	17.47	12.91	6.29	7.64	34.03	7.46	17.14	22.10
S_2	6.40	16.85	12.18	5.59	7.06	32.81	7.00	16.67	21.83
S_3	6.27	13.71	10.16	4.62	6.20	30.47	5.07	14.36	20.75
S_4	5.58	12.33	9.35	4.38	5.71	29.71	4.59	13.78	20.56
S. Em±	0.15	0.33	0.33	0.24	0.19	0.27	0.16	0.29	0.16
C. D.	0.44	0.99	0.99	0.71	0.57	0.82	0.49	0.89	0.47
	Interaction effect between varieties and spacing levels								
S_1V_1	6.67	18.73	13.27	6.19	7.73	33.84	7.81	17.98	22.40
S_1V_2	5.93	12.67	9.93	4.12	5.40	30.60	5.54	14.97	21.13
S_1V_3	8.60	21.00	15.53	8.55	9.80	37.66	9.06	18.49	22.78
S_2V_1	6.60	17.27	12.33	5.86	7.58	33.75	7.42	17.55	22.31
S_2V_2	5.80	12.60	9.13	3.68	5.20	29.95	4.82	14.42	20.51
S_2V_3	6.80	20.67	15.07	7.23	8.40	34.74	8.78	18.05	22.66
S_3V_1	6.33	13.60	10.27	4.80	6.40	31.52	3.50	13.40	21.47
S_3V_2	5.87	11.80	9.00	3.58	5.00	26.72	4.79	13.65	18.62
S_3V_3	6.60	15.73	11.20	5.49	7.20	33.18	6.94	16.04	22.17
S_4V_1	6.07	12.73	10.20	4.58	5.67	31.13	3.42	12.65	21.29
S_4V_2	4.20	10.27	7.53	3.56	4.67	25.82	4.48	12.97	18.47
S_4V_3	6.47	14.00	10.33	5.00	6.80	32.17	5.89	15.72	21.91
S. Em±	0.11	0.43	0.45	0.21	0.17	0.29	0.09	0.32	0.11

C. D.	0.23	0.87	0.91	0.43	0.36	0.59	0.19	0.65	0.21