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Effect of different cultivars and nutrient management on growth and yield of green gram (*Vigna radiata* L.)

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Abstract
The present investigation entitled " Effect of Different Cultivars and Nutrient Management on Growth and Yield of Green Gram (*Vigna radiata* L.) " was carried out at Crop Research Farm of National Post Graduate College, Barhalganj, Gorakhpur, (U P.) during zaid season on 2022 -23 with the objective to study the effect of different cultivars and Integrated Nutrient Management on growth, yield and quality of Green Gram (*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 a subtropical zone in indo gangetic planes.The experiment was laid out in Randomized Block Design with 9 treatment combinations and 3 replications. Green gram was sown on 16th February 2023 with treatment combinations viz. T_1 - Virat + RDF (20 : 60 : 20), T_2 - Virat + RDF + 2 ton FYM, T_3 - Virat + RDF+ 1 ton FYM + Rhizobium, T_4 - Samrat + RDF, T_5 - Samrat + RDF + 2 ton FYM, T_6 - Samrat+ RDF + 1 ton FYM+ Rhizobium, T_7 - Varsha + RDF, T_8 - Varsha + RDF + 2 ton FYM and T_9 - Varsha + RDF + 1 ton FYM + Rhizobium, respectively. The crop was harvested on 30th April 2023. The result indicated that the treatment combination T_3 - Virat + RDF + 1 ton FYM + Rhizobium was registered significantly superior in terms of plant height, (Cm), leaf area index, number of branches per plant, dry weight, number of nodules per plant, number of pods per plant, number of grains per pod, length of pods per plant, test weight (g), grain yield, straw yield, gross return (Rs/ha), net return (Rs/ha.) and benefit: cost ratio, respectively over rest of the treatments. Different cultivars, integrated use of organic manures along with optimum doses of chemical fertilizers increased the growth parameters and yield of Green gram.

Keywords: Green gram, cultivars, inorganic fertilizer, organic fertilizer, FYM, rhizobium, growth attributing parameters, yield attributing parameters, yield, stover yield

Introduction
Scientifically termed as *Vigna radiata* L. is grown in many countries around the world and alternatively known as Green gram, Moong bean, Green bean and golden gram belongs to the family lguminacae. Green gram, originated in Indian sub-continent (Candollle, 1886) [3]. It is a short duration (65 - 90 days) legumes grown on more than 6 million hectares globally in the warm areas. India is the largest producer of pulses and cultivated over 29 million hectares of area and recorded the highest ever production of 25. 23 Million tones during 2017–2018 (MoA&FW, India 2018) [5]. In spite of being the largest producer in the world our country has to import pulses to tune every year to meet the domestic requirements, the increment in the production being not able to maintain the pace with population growth (Chaturvedi and Ali 2002) [2].

In India, presently farmers grow more than a dozen pulses. Among them Chickpea, Pigeonpea, Urdbean, Greengram, Lentil, Fieldpea and Lathyrus are important. Among the kharif/summer pulse crops, green gram (*Vigna radiata* L.) has special importance in intensive crop production of the country for its short growing period (Ahmed *et al*., 1978) [1].

Pulses are least preferred by farmers because of high risk and less remunerative than cereal. Consequently, the production of the in pulses is significantly low to meet the demand of pulses. The majority of the Indian population is vegetarian, pulses are cheap and the best source of

protein for the Indian diet. It contains 20-25 percent protein, which is more than two times of cereals. The green plants can also be used as animal feed and its residues have the capacity to improve the physical, chemical and biological properties of soil, thus increasing the productivity of land. It can also fix atmospheric nitrogen through the symbiotic relationship.

Farmers grow this crop not as a principal crop but as a bonus crop, mixed with other crops on marginal lands and that too without manuring. By the introduction of numerous short duration varieties in green gram it had been feasible to introduce green gram in multiple cropping systems for increasing pulse production. Summer cultivation of green gram is being pushed to adjust between the time left after the harvesting of rabi and sowing of Kharif crops, where incidence of diseases and pests are relatively low and also the vacant land is efficiently utilized without affecting the maincrops. Greengram is a legume crop, it responds well to added nitrogen to overcome its lag phase and it influences nutrient uptake by promoting root growth and nodulation. Nitrogen enhances the uptake of other nutrients and increasing nitrogen content in the crop which increases the protein content of green garam.

It is a drought resistant crop and suitable for Dryland farming and predominantly used as an intercrop with other crops. In order to fulfil the requirement of a country, sometimes import of pulses is the usual process of the food trade of India. A number of high yielding varieties have been developed at different research stations of the state. These varieties yield two to three times more than the older varieties differ in their yielding potential under different climate and edaphic conditions. Different varieties of green gram have varying nutrient demand and climate adaptability. Therefore, selection of appropriate adoptable variety requires immediate and large efforts in the direction of a particular tract and distribution.

Integrated nutrient management facilitates better utilization of resources. In this approach, all possible organic sources of nutrients are applied based on economic consideration and the balance required for the crop is supplemented with chemical fertilisers. Use of FYM and Rhizobium is an important practice under INM as it is a cost effective and good source of nutrients and also has other benefits like enhancing the microbial population in the soil, acting as an absorbent material to hold moisture and soluble minerals etc. Biofertilizers too are one of the important ingredients in INM. Biofertilizers themselves are not really a source of nutrients but their application increases the availability of nutrients to the crops due to enhanced mineralization. Keeping the above facts in view, an attempt was made to study the effect of different cultivars and integrated nutrient management on growth and yield of green gram.

Materials 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 2022-23.The experimental site is situated in a subtropical zone in Indo - gangetic plains and lies between 260471 North latitude, 820101 East longitude and 1130m 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 - Virat + RDF (20 : 60 : 20), T_2 - Virat + RDF + 2 ton FYM, T_3 - Virat + RDF 1 ton FYM + Rhizobium, T_4 - Samrat + RDF, T_5- Samrat + RDF + 2 ton FYM, T_6- Samrat+ RDF + 1 ton FYM+ Rhizobium, T_7 - Varsha + RDF, T_8 - Varsha + RDF + 2 ton FYM and T_9 - Varsha + RDF + 1 ton FYM + Rhizobium, respectively. The sowing was done on the 16th February 2023. The crop was sown by using a seed rate of 25 kg per ha. and Nitrogen, Phosphorus and Potash were applied to the crops as per treatment of the experimental crops. The other agronomical cultural practices such as irrigation, weeding and plant protection measures have been performed as per requisite. Picking a mature pod was done manually at the maturity dated on 15th and 30th April 2023 and seed and straw were recorded.

Results and Discussion

Growth Parameters

As an experiment was conducted to observe the influence of Different Cultivars and Integrated Nutrient Management on Growth and Yield of Green Gram. The data pertaining to growth, yield and quality along with statistical interpretations are presented and discussed.

Different combinations of Cultivars and Integrated Nutrient Management had a significant effect on plant growth characters viz. plant height, leaf area index number of branches plant -1, dry weight and number of Rhizobium nodules per plant during the year of study given in Table - 1 clearly indicates that the maximum plant height, leaf area index number of branches plant -1, number of nodules per plant, and dry weight (46.50, 2.75, 8.55, 39.40 and 15.25, respectively) were recorded with the Treatment T_3 i. e Virat + RDF +1 ton FYM + Rhizobium) which were significantly superior over the rest of the treatment, while the lowest values were observed (plant height - 42.69 cm, leaf area index - 1.70, number of branches plant- 1 - 6.73 number of nodules per plant - 34.68 and dry weight - 11.47 g respectively) with the Treatment T_4 i.e. Samrat + RDF. The reason for higher values of growth parameters can be discussed in the light of fact that a variety can express its full yield potential under favourable managemental conditions and optimum level of required inputs.

Varietals respond to graded levels of fertilizer and sulphur is of great importance since varieties differ in their growth and developmental behaviour. Significant difference in plant height was observed due to their genetically different growth habit. These findings are substantiated with those reported by Dash and Rautaray (2017) [4]. This might be due to the fulfillment of major nutrient requirements along with organic manures viz. FYM and Rhizobium being a complete nutrient management, might have play an important physiological role by enhancing the cell division and multiplication, elongation and chlorophyll biosynthesis, which turn into better plant height. Almost similar findings were also reported by Patel *et al.*, (2018) [6]. Crops under these treatments had comparatively made easily extractable and more availability of nutrients than other treatments which resulted in better crop growth. It might be due to application of organic and inorganic fertilizer to help in higher nutrient mobility and therefore, plant uptake more nutrients by reducing nutrient losses through leaching, runoff etc. Application of various organic manures stimulated the plant growth, microbial activity and higher activity of soil enzymes. The higher plant height and dry matter accumulate with the application of F YM may also be due to the fact that in FYM mineralization is rapid, large portion of nitrogen, phosphorus and potassium in FYM is inorganic fractions. The addition of organic manure significantly influenced the beneficial micro-organisms to colonize in the rhizosphere and stimulate plant growth by providing necessary nutrients besides synthesis some plant harmone.

Table 1: Growth attributes of Green Gram as affected by different Cultivars and Integrated Nutrient Management

Treatment	Plant height (cm)	Leaf area index	No. of branches plant^{-1}	No. of Nodules plant^{-1}	Dry weight (g)
T_1	43.25	2.41	6.99	33.50	11.85
T_2	45.10	2.40	7.21	36.70	12.05
T_3	46.50	2.75	8.55	39.40	15.25
T_4	42.69	1.70	6.73	34.68	11.47
T_5	44.50	2.10	7.24	36.00	12.95
T_6	44.85	2.35	7.58	36.14	13.80
T_7	43.95	2.31	7.70	35.62	13.39
T_8	44.00	2.40	7.79	34.92	13.75
T_9	45.25	2.62	7.98	36.42	14.24
S.Em±	0.12	0.01	0.21	0.83	0.24
C.D.	0.26	0.03	0.45	1.75	0.51

Yield Parameters

Number of pods per plant, number of seeds per pod, Length of pods per plant (Cm), test weight (g) yield (q ha^{-1}) and stover yield (q ha^{-1}) as influenced by different combinations of Cultivars and Integrated Nutrient Management have been shown in Table - 2 clearly indicates that number of pods per plant, number of seeds per pod, Length of pods per plant (Cm), test weight (g) yield (q ha^{-1}) and stover yield (q ha^{-1}) as (20.60, 11.20, 9.97 cm, and 34.47g, 14.20 q ha^{-1}, and 27.90 q ha^{-1}, respectively) were recorded highest with the Treatment T_3 i.e. Virat + RDF + 1 ton FYM + Rhizobium, while the lowest values were observed (16.40, 9.13, 6.50 cm,30.69 g 11.45 q ha^{-1}, and 25.10 q ha^{-1}, respectively) with the Treatment T_4 - i.e. Samrat + RDF. This might be due to a variety of crop differed in its genetic built up along with almost all the yield attributing characters were found remarkably higher under the same variety, hence resulted in the higher yield. The above findings are in complete agreement with earlier work of Rathod and Gawande (2012) [9], and Puniya *et al*., (2017) [7]. All yield attributing characters found remarkably lower under the treatment Samrat + RDF. The increase in yield attributes under Virat + 1 ton FYM + Rhizobium along with major nutrient helps in improve overall nutritional environment in the rhizosphere as well as availability of the nutrients for plants, which turn in to enhance the plant metabolism and photosynthetic activity resulting in better growth and yield attributes of plants. Positive responses in terms of yield attributes due to application of major nutrients along with FYM + Rhizobium have also been reported. The present results closely resembled those of Rani *et al*. (2016) [8].

Table 2: Yield attributes and yield of Green Gram as affected by different Cultivars and Integrated Nutrient Management

Treatment	No. of pods plant^{-1}	No. of grain pods^{-1}	Length of pods plant^{-1}	Test weight (g)	Grain yield (q ha^{-1})	Stover yield (q ha^{-1})
T_1	17.25	09.40	7.18	31.61	11.83	26.10
T_2	18.90	10.40	8.51	32.52	13.45	26.90
T_3	20.60	11.20	9.97	34.47	14.20	27.90
T_4	16.40	09.13	6.50	30.69	11.45	25.10
T_5	17.50	09.82	8.32	32.50	13.10	26.99
T_6	18.90	09.98	8.24	32.63	13.52	27.10
T_7	17.20	10.37	8.88	32.95	11.60	27.19
T_8	17.40	10.62	8.83	33.58	13.20	27.05
T_9	20.52	10.45	9.22	33.97	13.60	27.25
S.Em±	1.00	0.35	0.71	0.61	1.58	2.81
C.D.	2.12	0.74	1.51	1.30	3.35	5.95

Economic Feasibility

To examine the economic feasibility and viability of different treatments under investigation, economics of Green gram 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.

Table 3: Gross return, net return and benefit: cost ratio of Green Gram as affected by different Cultivars and Integrated Nutrient Management

Treatment	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	Benefit: Cost ratio
T_1	101241.14	63526.14	1.68
T_2	115105.10	72390.10	1.69
T_3	121523.60	80808.60	1.98
T_4	97989.10	60649.61	1.62
T_5	112109.80	69769.80	1.64
T_6	115704.16	75364.16	1.86
T_7	99272.80	61182.80	1.60
T_8	112965.60	69875.60	1.62
T_9	116388.80	75298.80	1.82

It is obvious from the above Table that the Treatment T_3 i.e. Virat + RDF + 1 ton FYM + Rhizobium was registered with the highest gross return (Rs. 121523.60), net return (Rs. 80808.60) and benefit cost ratio (1.98) per ha., this might be due to higher yield in the treatment compared to other treatments.

Conclusion

Based on the experimental findings, it may be concluded that Virat + RDF + 1 ton FYM + Rhizobium has been proved to be an ideal to exploit the maximum yield.

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