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

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Abstract
A field experiment was conducted at Agronomy Research Farm of Faculty of Agriculture and Veterinary Science, Mewar University, Gangrar, Chittorgarh (Rajasthan) during *kharif* 2024 on loamy sand soil, which consisted eleven treatments *viz*. *viz*., T_0-Control, T_1-Seed treatment with Rhizobium at 20 g kg^{-1} seed, T_2-Vermicompost at 2.5 t ha^{-1}, T_3-FYM at 5 t ha^{-1}, T_4-100% RDF, T_5-Rhizobium + Vermicompost at 2.5 t ha^{-1} + FYM at 5 t ha^{-1}, T_6-Rhizobium + FYM at 5 t ha^{-1}, T_7-Rhizobium + 100% RDF at 25:50 kg ha^{-1}, T_8-Vermicompost at 2.5 t ha^{-1} + FYM at 5 t ha^{-1}, T_9-Vermicompost at 2.5 t ha^{-1} + 100% RDF at 25:50 kg ha^{-1} and T_{10}: FYM @ 5 t ha-1 + 50% RDF @ 12.5:25 (N:P) were applied to the green gram *var*. RC-19. were laid out in randomized block design with three replication.
Results clearly showed that application of T_9-Vermicompost at 2.5 t ha^{-1} + 100% RDF at 25:50 kg ha^{-1} which was remained at par with treatment of T_5-Rhizobium + Vermicompost at 2.5 t ha^{-1} + FYM at 5 t ha^{-1} and superior to all other treatments in respect to significantly increased growth attributes *viz*. plant height, plant dry matter, number of branches $plant^{-1}$, number of nodules $plant^{-1}$, and yield parameters *viz*. number of pods $plant^{-1}$, number of seeds pod^{-1}, seed, straw and biological yield over control.

Keywords: Green gram, Vermicompost, RDF, rhizobium

Introduction
Green gram (*Vigna unguiculata* L. Walp), belonging to the family Fabaceae is an important *kharif* pulse crop grown in India for grain, forage and for green manure purpose. Green gram is grown both for its tender pods and also for its dry seeds used as pulse for culinary purpose. It is a warm season crop, well adapted to many areas of humid tropics and subtropical zones. In India, it is grown widely round the year. Green gram is also called as catch crop due to well adoption in short time when main crop failed with better biological value on dry weight basis. Green gram grain contains 25 percent protein, 1.8 percent fat and 60.3 percent carbohydrates on dry weight basis and it is rich source of calcium and iron. Apart from this, Green gram forms excellent forage and it gives a profused vegetative growth and covers the ground so well that it checks the soil erosion. Green gram pods are good source of protein, fibre, minerals, calcium and vitamins particularly vitamin A and vitamin C. It contains 8 g carbohydrates, 43 g proteins and 0.6 g fat, 2 g fiber per 100 g of edible portion. Tender fruits contain 80 mg calcium, 74 mg phosphorus and 2.5 mg iron per 100 g fresh pod, amino acid profile is particularly high in Green gram which greatly improves the protein quality of pulses (Gopalakrishnan, 2007) [3]. The factors attributed for low yields of pulses in India as compared to the world productivity are non-availability of quality seeds of improved and short duration varieties, growing of pulses under marginal and less fertile soil with low inputs and without pest and disease management, growing of pulses under moisture stress, unscientific post harvest practices and storage under unfavorable conditions. Hence, there is a scope for improving the production potential of this crop by use of organic, inorganic and bio-fertilizers.

Materials and Methods
The field experiments were carried out during *kharif* season (2024) to study the "Effect of Integrated Nutrient Management on Growth and Yield of Summer Green Gram (*Vigna radiata* L.)" in randomized block design with 11 treatments and 3 replication at Research Farm, Mewar University-Chittorgarh, Rajasthan. The experimental farm is geographically located at 75°51'44" E longitude, 26°48'35'' N latitude and an altitude of 432 m above

mean sea level (AMSL). The experimental fields were clay loam and the soil fertility status contained available nitrogen (137.8 kg ha^{-1}) by Subia and Asija 1996, available phosphorus (16.3 kg ha^{-1}) by Olsen *et al*. 1954 [7] and available potassium (250.12 kg ha^{-1}) by Jackson, 1973 [4]. The organic carbon content was from 0.34-0.38 percent. The weekly mean maximum and minimum temperatures were of temperature during both summers (40.6° C) and winters (2.7° C). The mean relative humidity fluctuated from 63.50 to 91 percent during the crop season. The average rainfall is 557 mm per annum, which is mostly received during July to September. The sporadic showers during winters are also common, which are probably observed during this period. The experiments were laid out in randomized block design with three replications and nine treatments. The following treatments were included in the study, T_0-Control, T_1-Seed treatment with Rhizobium at 20 g kg^{-1} seed, T_2-Vermicompost at 2.5 t ha^{-1}, T_3-FYM at 5 t ha^{-1}, T_4-100% RDF, T_5-Rhizobium + Vermicompost at 2.5 t ha^{-1} + FYM at 5 t ha^{-1}, T_6-Rhizobium + FYM at 5 t ha^{-1}, T_7-Rhizobium + 100% RDF at 25:50 kg ha^{-1}, T_8-Vermicompost at 2.5 t ha^{-1} + FYM at 5 t ha^{-1}, T_9-Vermicompost at 2.5 t ha^{-1} + 100% RDF at 25:50 kg ha^{-1} and T_{10}: FYM @ 5 t ha-1 + 50% RDF @ 12.5:25 (N:P). The observation were recorded at harvest was analysed by Statistical methods (Fisher, R.A. 1950.) [2]

Results and Discussion

It is clear from the result of present study that, integrated nutrient management had significantly affected the growth and yield parameters at harvest of green gram. Application of T_9-Vermicompost at 2.5 t ha^{-1} + 100% RDF at 25:50 kg ha^{-1} recorded the highest growth attributes like plant height (71.01 cm), dry matter accumulation (362.1 g m^{-2}), number of branches plant^{-1} (22.7) and number of branches plant^{-1} (13.7) at harvest (Table 1) which was remained at par with T_5-Rhizobium + Vermicompost at 2.5 t ha^{-1} + FYM at 5 t ha^{-1}. Plant height and dry matter accumulation increased with the application of T_9 due to increased cell division and cell elongation at higher level of nutrients. The integrated approaches of nutrients (inorganic, organic and biofertilizers) that the plant needs to play an important role in the metabolic processes that take place inside the plant. (Rajput *et al*. 2009 [8], Devi *et al*., 2013 [1] and Tyagi and Singh, 2019) [11]. Further yield attributes and yields like number of pods plant^{-1} (14.2), number of seeds pod^{-1} (14.8), seed yield (1292.9 kg ha^{-1}), stover yield (2492.0 kg ha^{-1} kg ha^{-1}) and biological yield (3784.0 kg ha^{-1}) (Table 2) recorded with the application of T_9-Vermicompost at 2.5 t ha^{-1} + 100% RDF at 25:50 kg ha^{-1}. However, test weight and harvest index (Singh and Stoskopt, 1971) [9] was found non significant by integrated nutrient management in green gram. Yield components by enhancing cell division, cell elongation process and photosynthetic activity leading to production and accumulation of more carbohydrates and auxins which favours retention of more flowers ultimately leading to more number of reproductive parts plant^{-1}. Higher plant dry matter recorded under the application of T_9-Vermicompost at 2.5 t ha^{-1} + 100% RDF at 25:50 kg ha^{-1} which is directly related to yields. Similar results were also reported by Maur *et al*. (2017) [5] and Muindi *et al*. (2019) [6].

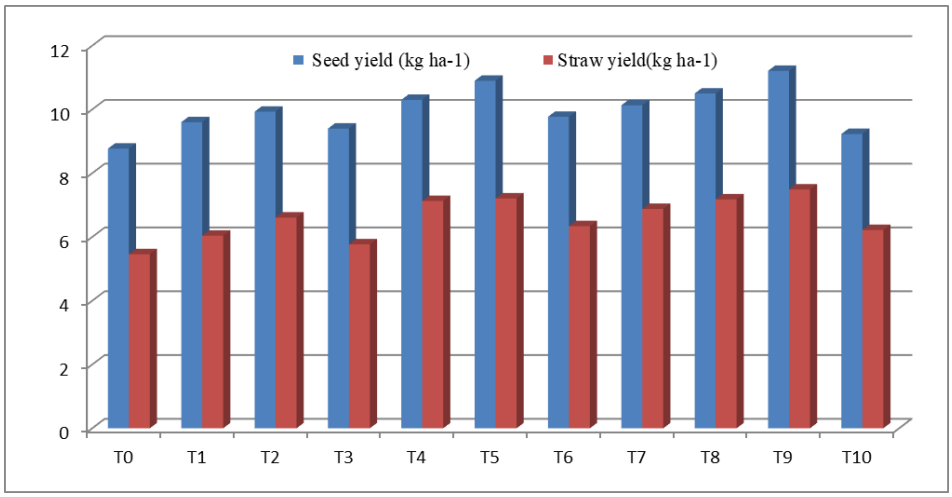
Table 1: Effect of integrated nutrient management on growth attributes of green gram

Treatments	Plant height (cm)	Plant dry matter (g m^{-2})	Number of branches plant^{-1}
T_0: Control	49.13	266.18	5.53
T_1: Seed Treatment with Rhizobium @ 20 g kg^{-1} seed	58.03	315.85	6.46
T_2: Vermicompost @ 2.5 t ha^{-1}	66.3	332.4	7.15
T_3: FYM @ 5 t ha^{-1}	57.93	299.5	6.30
T_4: 100% RDF	75.5	345.14	7.93
T_5: Rhizobium+ Vermicompost @ 2.5 t ha^{-1} + FYM @ 5 t ha^{-1}	85.53	355.07	8.87
T_6: Rhizobium + FYM @ 5 t ha^{-1}	65.53	323.97	7.03
T_7: Rhizobium + 100% RDF @ 25:50 kg ha^{-1}	74.11	342.47	7.83
T_8: Vermicompost @ 2.5 t ha^{-1} + FYM @ 5 t ha^{-1}	77.23	352.89	8.03
T_9: Vermicompost @ 2.5 t ha^{-1} + 100% RDF @ 25:50 kg ha^{-1}	87.96	362.11	8.93
T_{10}: FYM @ 5 t ha-1 + 50% RDF @ 12.5:25 (N:P)	62.53	308.97	7.01
SEm±	2.31	16.39	0.34
CD at (p= 0.05)	4.86	32.70	0.62
CV (%)	9.40	8.61	7.79

Table 2: Effect of integrated nutrient management on growth attributes of green gram

Treatments	Number of pods plant^{-1}	Number of seeds pod^{-1}	Test weight (g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
T_0: Control	8.77	5.46	30.30	8.77	5.46	30.30	8.77
T_1: Seed Treatment with Rhizobium @ 20 g kg^{-1} seed	9.60	6.04	36.34	9.60	6.04	36.34	9.60
T_2: Vermicompost @ 2.5 t ha^{-1}	9.93	6.61	39.32	9.93	6.61	39.32	9.93
T_3: FYM @ 5 t ha^{-1}	9.40	5.77	33.54	9.40	5.77	33.54	9.40
T_4: 100% RDF	10.3	7.13	41.72	10.3	7.13	41.72	10.3
T_5: Rhizobium+ Vermicompost @ 2.5 t ha^{-1} + FYM @ 5 t ha^{-1}	10.9	7.21	42.32	10.9	7.21	42.32	10.9
T_6: Rhizobium + FYM @ 5 t ha^{-1}	9.77	6.34	36.79	9.77	6.34	36.79	9.77
T_7: Rhizobium + 100% RDF @ 25:50 kg ha^{-1}	10.13	6.88	40.36	10.13	6.88	40.36	10.13
T_8: Vermicompost @ 2.5 t ha^{-1} + FYM @ 5 t ha^{-1}	10.50	7.18	42.00	10.50	7.18	42.00	10.50
T_9: Vermicompost @ 2.5 t ha^{-1} + 100% RDF @ 25:50 kg ha^{-1}	11.21	7.49	45.98	11.21	7.49	45.98	11.21
T_{10}: FYM @ 5 t ha-1 + 50% RDF @ 12.5:25 (N:P)	9.23	6.22	35.3	9.23	6.22	35.3	9.23
SEm±	0.14	0.08	1.39	0.14	0.08	1.39	0.14
CD at (p= 0.05)	0.43	0.23	NS	0.43	0.23	NS	0.43
CV (%)	8.48	7.89	8.99	8.48	7.89	8.99	8.48

Graph 1: Effect of integrated nutrient management on growth attributes of grain gram



Graph 2: Effect of integrated nutrient management on seed yield and straw of gran gram

Conclusion

In light of the results obtained from the present investigation, it may be concluded that the treatments T_9: Vermicompost @ 2.5 t ha^{-1} + 100% RDF @ 25:50 kg ha^{-1} effective in increasing plant height, plant dry matter, number of branches $plant^{-1}$, number of pods $plant^{-1}$, seed, straw and biological yield of graan gram.

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