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Response of Integrated Nutrient Management on Growth of Greengram (*Vigna radiata* L.)

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Abstracts

To study the response of integrated nutrient management on growth parameters of greengram (Vigna radiata L.) during kharif season 2021 a field experiment was carried out at Crop Research Centre, ITM University, Gwalior, M.P. The soil belonged to the sandy loam textural class (pH 7.35; EC 0.40 dSm^{-1}). The randomized block design (RBD) was used with three replications and ten treatments in the combination of inorganic fertilizers, Rhizobium, PSB, and FYM. This study indicated that the treatment T_{10}: 125% RDF (20:40:20 kg NPK ha^{-1}) + PSB (2.5 g kg^{-1} seeds) + Rhizobium (2.5 g kg^{-1} seeds) + FYM (2.5 tonnes ha-1)significantly increased plant height, dry matter accumulation plant^{-1}, leaf area index, and number of leaves plant^{-1}. As a result, increasing growth was made possible by adding farmyard manure, together with rhizobium and psb. These results demonstrate that yields with integrated use of several nutrient sources were obtained utilizing inorganic fertilizers, bio-fertilizers, and the addition of organic matter as compared to T_1 (control) and T_2: chemical treatment (100% RDF).

***Keywords:** Farm yard manure, Green gram, Growth, INM, PSB, Rhizobium, Vigna radiata*

Introduction

One of the major worldwide food crops is pulses. The world's top importer (14% of total imports), consumer (27% of total consumption), and producer (25% of total output) of pulses is India[5]. Pulses account for 7–10% of the nation's total grain production and are grown on about 20% of the nation's acreage. The green gram is one of the most important pulses grown in India. It is a pulse crop that can withstand drought and grows quickly; it is also known as "mungbean." Its seed is made up of 51% carbohydrates, 3% vitamin, and 20–25% protein[4]. India is top in the world for green gram production, and it is grown in almost all States. It is produced on around 4.5 million hectares, yielding 2.64 million tonnes at a productivity of 548 kg/ha, and making up 10% of all pulse production in 2020–21. States that produce the majority of India's pulses include Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Karnataka, Telangana, and Andhra Pradesh.

All nutrient sources, including organic, inorganic (chemical fertilizers), and biofertilizers, can be combined and applied to soils through the idea of integrated nutrient management in order to encourage crop growth and boost the yields of high-quality goods. Artificial fertilizers, on the other hand, are crucial in assisting the crop in obtaining the nutrients it requires. When utilized in an uneven way, chemical fertilizers have negative effects on the physical, chemical, and biological components of soil, which not only causes environmental contamination but also compromises agricultural production's sustainability.

Compared to other bio-fertilizers, rhizobium inoculation is the least expensive, most straightforward, and risk-free means of supplying nitrogen to green gram through the well-known symbiotic nitrogen fixation process. Phosphate-solubilizing bacteria (PSB) are essential for converting unavailable inorganic P (Ca-P, Fe-P, and Al-P) into available inorganic P forms by secreting organic acids and enzymes[9]. As a result, there may be a large reduction in the amount of nitrogen and phosphorus that must be applied when seeds are inoculated with Rhizobium and bacteria that dissolve phosphate. Farmyard manure (FYM) contains a sizable amount of nutrients that become available to plants as it decomposes, increasing the availability of both naturally occurring and applied nutrients[9].

Materials and Methods

The field experiment was carried out in the Kharif season of 2021–2022 at the Crop Research Centre, School of Agriculture, ITM University, Gwalior, (M.P.) (26.1495' N latitude, 78.1873' E longitude, and 211m Altitude). It is located in India's Grid region.The semi-arid climate of Gwalior is characterized by temperature extremes in both the summer and the winter. Mid-June through mid-September is the start of the southwest monsoon season. Between 650 and 700 mm of precipitation fall annually on average. The soil in the experimental field had the following physico-chemical characteristics: sandy loam texture, soil reaction (pH) of 7.35, EC of 0.40 dSm^{-1}, low organic carbon of 0.11%, available nitrogen of 67 kg ha^{-1}, low available phosphorus of 14.5 kg ha^{-1}, and potassium of 238.4 kg ha^{-1}. Sand made up 54.24 % of the soil, silt 23.56 %, clay 22.11 %.

The Greengram variety was Samrat with average duration of 60-75 days was used as an experimental crop. The experiment had a randomized block design with ten nutrient management treatments, viz., T_1: control; T_2: 100% RDF (20:40:20 NPK kg ha^{-1}); T_3: 75% RDF+PSB (25 g kg^{-1} seeds); T_4: 75% RDF+ Rhizobium (25 g kg^{-1} seeds); T_5: 75% RDF+FYM (2.5 t ha^{-1}); T_6: 75% RDF+PSB (25 g kg^{-1} seeds)+ Rhizobium (25 g kg^{-1} seeds); T_7: 75% RDF+PSB (25 g kg^{-1} seeds)+ Rhizobium (25 g kg^{-1} seeds)+ FYM (2.5 ton ha^{-1}); T_8: 50%RDF+PSB (25g kg^{-1} seeds) + Rhizobium (25 g kg^{-1} seeds)+ FYM (2.5 ton ha^{-1}).; T_9: 100%RDF+PSB (25g kg^{-1} seeds) + Rhizobium (25 g kg^{-1} seeds)+ FYM (2.5 ton ha^{-1}); and T_{10}: 125%RDF+PSB (25g kg^{-1} seeds) + Rhizobium (25 g kg^{-1} seeds)+FYM (2.5 ton ha^{-1}). As nitrogen, phosphorus, and potassium sources, urea, SSP, and MOP were employed, respectively. Following the application of a base dose of fertilizer in each plot in accordance with the treatment allocation, unfurrows were opened by around 5 cm. The seeds were then treated with PSB (at 25 g kg^{-1} seed) and Rhizobium (at 25 g kg^{-1} seed). As soon as the inoculated seeds were dry, they were sowed after drying in the shade. All advised agronomic procedures were regularly followed to grow the crop. In the course of the experiment, measurements of plant growth were taken at 20, 40, and 60 days after sowing (DAS) as well as at the point of harvest. The recorded data were put through statistical analysis using the proper methodology[10].

Results and Discussion

The highest plant height was reported in T_{10}: 125% RDF + PSB + Rhizobium + FYM and at par to T_9: 100% RDF + PSB + Rhizobium + FYM, the plant height (Table.1) at 40 DAS, 60 DAS, and throughout the later stages of crop growth, was much greater than the other treatments. In the cases of treatments T_{10}:

125% RDF + PSB + Rhizobium + FYM and T_9: 100% RDF + PSB + Rhizobium + FYM, the results of the higher levels of nutrients and integration of several sources of nutrients had a substantial impact on crop and development metrics. Both therapies have Yielded results that are equivalent to and noticeably better than those of the other treatments. All of the treatments utilizing NPK, FYM, and bio-fertilizer significantly improve plant growth when compared to the control[6,8].

Table 1 Response of integrated nutrient management on plant height at various growth stages

Treatments	plant height (cm)		
	20 DAS	40 DAS	60 DAS
T1: Control	12.53	17.41	25.04
T2: 100% RDF	12.74	21.12	30.26
T3: 75% RDF + PSB	13.17	25.28	36.36
T4: 75% RDF +	13.59	25.42	36.64
Rhizobium			
T5: 75% RDF + FYM	13.09	25.04	36.02
T6: 75% RDF + PSB +	13.87	29.12	41.86
Rhizobium			
T7: 75% RDF + PSB +	14.32	32.84	42.04
Rhizobium + FYM			
T8: 50% RDF + PSB +	12.96	21.32	30.79
Rhizobium + FYM			
T9: 100% RDF + PSB + Rhizobium + FYM	14.67	36.56	47.26
T10: 125% RDF + PSB +	15.17	36.82	47.58
Rhizobium + FYM			
S.Em±	0.65	1.24	1.75
C.D at 5%	NS	3.69	5.19

The dry matter accumulation (Table 2) of green gram was dramatically impacted by the INM treatments. The green gram crop collected the most dry matter at the harvest stage when it was treated with 125% RDF + PSB + Rhizobium + FYM (387.93 g m^{-2}), whereas T_9 treatments, which included 100% RDF + PSB + Rhizobium + FYM, accumulated 376.82 g m^{-2} at par levels and were followed by T_7 treatments (335.76 g m^{-2}). The concomitant use of higher doses of NPK inorganic source of fertilizer, organic source of nutrients like FYM, and biofertilizer which enables nutrient availability during the entire crop growth period, improves soil health and soil microflora, resulting in higher accumulation, may be the cause of the higher dry mater accumulation in these treatments than the RDF and control treatments. The results are in line with the studies of earlier workers[3].

Table 2 Response of Integrated nutrient management on plant dry matter

Treatments	Plant dry matter (g m^{-2})		
	20 DAS	40DAS	60 DAS
T_1: Control	25.02	90.41	155.24
T_2: 100% RDF	32.54	113.43	196.56
T_3: 75% RDF + PSB	47.96	138.28	247.12
T_4: 75% RDF + Rhizobium	48.31	139.32	253.41
T_5: 75% RDF + FYM	47.64	137.12	242.18
T_6: 75% RDF + PSB + Rhizobium	55.91	162.36	294.49
T_7: 75% RDF + PSB + Rhizobium + FYM	63.42	185.46	335.76
T_8: 50% RDF + PSB + Rhizobium + FYM	40.12	114.12	201.15
T_9: 100% RDF + PSB + Rhizobium + FYM	70.96	208.56	376.82
T_{10}: 125% RDF + PSB + Rhizobium + FYM	74.29	215.56	387.93
S.Em±	2.42	7.12	13.6
C.D at 5%	7.2	21.16	38.81

According to the findings , the T_{10} treatment had the highest leaf area index (Table 3) at all growth stages (1.11, 2.96, 4.88, at 20, 40, and 60, respectively) and was significantly better than the other treatments, with the exception of the T_9 (100% RDF + PSB + Rhizobium + FYM) treatment, which is at par. When it came to the leaf area index (LAI), it was discovered that it increased gradually as the crop aged up to 60 DAS before beginning to drop approaching harvest after that point. This might be because there were more nutrients available due to the use of combined organic and inorganic sources, which may have led to the development of more leaves and leaf expansion, which in turn led to an increase in leaf output[1].

Table 3 Response of integrated nutrient management on leaf area index

Treatment	Leaf area index		
	20 DAS	40 DAS	60 DAS
T_1: Control	1.01	1.12	2.19
T_2: 100% RDF	1.02	1.42	2.71
T_3: 75% RDF + PSB	1.06	1.83	3.26
T_4: 75% RDF + Rhizobium	1.07	1.88	3.27
T_5: 75% RDF + FYM	1.04	1.78	3.21
T_6: 75% RDF + PSB + Rhizobium	1.08	2.19	3.77
T_7: 75% RDF + PSB + Rhizobium + FYM	1.09	2.51	4.28
T_8: 50% RDF + PSB + Rhizobium + FYM	1.03	1.47	2.76
T_9: 100% RDF + PSB + Rhizobium + FYM	1.1	2.82	4.78
T_{10}: 125% RDF + PSB + Rhizobium + FYM	1.11	2.96	4.88
S.Em±	0.05	0.09	0.16
C.D at 5%	NS	0.27	0.48

The treatment with 125% RDF + PSB + Rhizobium + FYM (T_{10}) had the most leaves per plant (Table 4), and it was significantly on par with the treatment with 100% RDF + PSB + Rhizobium + FYM (T_9), which had significantly more leaves than the other treatments at 20, 40, and 60, respectively. Because organic manure and synthetic fertilizers progressively release nutrients, applying both at once increases nutrient availability over longer crop duration. Better nitrogen absorption boosted vegetative development since nitrogen is an essential component of proteins and chlorophyll. The availability of soil phosphorus, which is generally primarily fixed in the soil, was further enhanced by the addition of Phosphate Solubilizing Bacteria (PSB). Given the crop's superior development in terms of leaf area index and number of leaves, increased nutrition availability from an early stage was evident. Similar findings were reported by many others[7,11].

Table 4 Response of Integrated Nutrient Management on leaves of the plant

Treatments	No. of leaves/plant		
	20 DAS	40 DAS	60 DAS
T_1: Control	7.58	13.34	22.34
T_2: 100% RDF	7.71	16.24	27.36
T_3: 75% RDF + PSB	8.4	19.26	32.51
T_4: 75% RDF + Rhizobium	8.74	19.31	32.59
T_5: 75% RDF + FYM	8.28	19.21	32.43
T_6: 75% RDF + PSB + Rhizobium	8.86	22.21	37.61
T_7: 75% RDF + PSB + Rhizobium + FYM	9.12	25.11	42.61
T_8: 50% RDF + PSB + Rhizobium + FYM	7.93	16.31	27.43
T_9: 100% RDF + PSB + Rhizobium + FYM	9.5	28.01	47.62
T_{10}: 125% RDF + PSB + Rhizobium + FYM	9.73	28.13	47.86
S.Em±	0.49	0.96	1.64
C.D at 5%	NS	2.85	4.87

References

1. Aslam, M. and Nagavani, A.V. (2019). Response of greengram (*Vigna radiata* L.) to foliar nutrients and bio-stimulants. M.Sc. (Ag.) Thesis, Acharya N.G. Ranga Agricultural University, Guntur, A.P., India.
2. Chand, S. (2007). Effect of integrated nutrient management on yield and nutrient use efficiency in mustard (*Brassica juncea* L.). *SAARC Journal of Agriculture*, 5: 93–100.
3. Dhakal, Y., Meena, R.S. and Kumar, S. (2016). Effect of INM on nodulation, yield, quality, and available nutrients status in the soil after harvest of green gram (*Vigna radiata* Wilczek), *Legume Research*, 39: 590-59.
4. Ganesan, K. and Xu, B. (2018). A critical review on phytochemical profile and health promoting effects of mung bean (*Vigna radiata*). *Food Science and Human Wellness*, 7: 11-33.
5. GoI. (2015). Agricultural Statistics at a Glance (2014). Directorate of Economics and Statistics, Ministry of

Agriculture, Government of India, New Delhi pp. 1–452.

6. Kumar, V. and Singh, A.P. (2010). Long-term effect of green manuring and FYM on yield and soil, fertility status in the rice-wheat cropping system. *Indian Society of Soil Science*, 6: 409-412.
7. Meena, S., Swaroop, N. and Dawson, J. (2016). Effect of Integrated nutrient management on growth and yield of greengram (*Vigna radiata* L.). Agricultural Science Digest, *a Research Journal*, 36(1): 63 65.
8. Pandey, O.P., Shahi, S.K., Dubey, A.N. and Maurya, S.K. (2019). Effect of integrated nutrient management of growth and yield attributes of green gram (*Vigna radiata* L.). *Journal of Pharmacognosy and Photochemistry*, 8: 2347-2352.
9. Singh, M.V. (1999). Sulphur management for oilseed and pulse crops. *Indian Institutes of Soil Science* (Bhopal) Bulletin No. 3. pp 2–5.
10. Snedecor, G.W. and Cochran, W.G. (1994). Statistical Methods. Iowa State University Press, Ames, pp. 491.
11. Tyagi, P.K. and Upadhyay, A.K. (2015). Effect of integrated nutrient management on Yield, quality, nutrients uptake and economics of summer Greengram. *Annals of Plant and Soil Research*, 17(3): 242-247.