E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; 7(5): 673-677
Received: 24-02-2024
Accepted: 29-03-2024

Implication of organic manures on the yield, growth, and quality of green gram under organic farming (*Vigna radiata* L.)

Aniket Raj, Ravikesh Kumar Pal, Sudhanshu Singh, Awanindra Kumar Tiwari, Durgesh Kumar Maurya, Akash Raj, Mandeep Kumar and Shravan Kumar Maurya

DOI: https://doi.org/10.33545/2618060X.2024.v7.i5i.756

Abstract
A field experiment was conducted during rabi season of 2023-24 on loamy sand of in the rural area of Kanpur district of Mandhana, located 10 km from Kanpur in Uttar Pradesh the Implication of organic manures on the yield, growth, and quality of green gram under organic farming (*Vigna radiata* L.).The soil was normal in pH of 7.62, electrical conductivity (EC) of 0.25 dSm^{-1}, organic carbon content of 0.42%, and available nutrients including nitrogen (N), phosphorus (P), and potassium (K) at levels of 216.10, 19.12, and 149.30 kg ha^{-1}, respectively. The experiment was laid out during summer season of 2023-24. The experiment consisted of 12 treatment combinations (four level of phosphorus and 3 level of Biofertilizers), was laid out in Randomized Block Design (RBD) with three replications.

Keywords: Phosphorus, biofertilizers, mungbeen, nutrients

Introduction

The pulses (A Pulse, Latin "puls" from Ancient Greek Poltos "porridge") are annual leguminous crops that hold a special place in Indian agriculture due to their innate ability to grow on marginal land and to supply the nation's poor and vegetarians with a diet rich in protein. In addition to being a great source of protein, pulses are essential to sustainable agriculture because they improve the biological, chemical, and physical qualities of soil and function as tiny nitrogen factories. As such, Swaminathan (1981) [1] appropriately refers to them as "Unique Jewels of Indian crop husbandry." Due to their compatibility with various crop rotations, pulses are an essential component of cropping systems.

The calorific value of one hundred grams of green grams is 334 calories. Its chemical composition is as follows: 24.0 percent crude protein, 1.3 percent fat, 56.6 percent carbohydrate, 3.5 percent minerals, 0.43 percent lysine, 0.10 percent methionine, 0.04 percent tryptophan, 124 miligram calcium, 3.26 miligram phosphorus, and 7.3 miligram iron (Kachroo, 1970) [2].

With roughly one-third of the global area and one-fourth of the global production of pulses, India is the world's leading pulse-growing nation. With an average productivity of 853 kg per ha, India is currently the world's largest producer of pulses, covering 29.81 million hectares and contributing 25.42 million tons of production (Anonymous, 2018) [3].

In parts of Asia that include India, Pakistan, Bangladesh, Sri Lanka, Thailand, Cambodia, Vietnam, Indonesia, Malaysia, and South China, it is widely grown. In India, greengram is grown on 38.32 lakh hectares and yields 17.84 lakh tons, with an average productivity of 407 kg per hectare (Anon., 2018) [3]. On 0.51 lakh hectares in Uttar Pradesh, greengram cultivation is ready to produce 0.22 lakh tons of greengrams annually at an average yield of 526 kg per hectare (Anon., 2018) [3]. Between 10 and 12 percent of all pulses produced in the nation are greengrams. The top two states, each contributing more than 45 percent, are Rajasthan (26 percent) and Maharashtra (20 percent), according to the most recent estimates. While Andhra Pradesh contributes almost 10% of the nation's total production, Gujarat only makes up about

Aniket Raj
M.Sc. (Ag) Scholar, Agronomy, Faculty of Agriculture Science and Allied Industries, Rama University, Kanpur, Uttar Pradesh, India

Ravikesh Kumar Pal
Assistant professor, Agronomy, Faculty of Agriculture Science and Allied Industries, Rama University, Kanpur, Uttar Pradesh, India

Sudhanshu Singh
Department of Vegetable Science, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, Uttar Pradesh, India

Awanindra Kumar Tiwari
Scientist- Plant Protection (Entomology) Krishi vigyan Kendra Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Durgesh Kumar Maurya
Assistant professor, Agronomy, Faculty of Agriculture Science and Allied Industries, Rama University, Kanpur, Uttar Pradesh, India

Akash Raj
M.Sc. (Ag) Scholar, Agronomy, Faculty of Agriculture Science and Allied Industries, Rama University, Kanpur, Uttar Pradesh, India

Mandeep Kumar
Department of Agronomy CSA University, Kanpur, Uttar Pradesh, India

Shravan Kumar Maurya
Department of Agronomy CSA University, Kanpur, Uttar Pradesh, India

Corresponding Author:
Ravikesh Kumar Pal
Assistant professor, Agronomy, Faculty of Agriculture Science and Allied Industries, Rama University, Kanpur, Uttar Pradesh, India

7% of it Anon., 2018) [3].

Greengram (*Vigna radiata* L.), one of the most important and widely grown pulse crops, is one of the pulses. Greengram, also known as "mung," "mungbean," or "golden gram," is known to be an excellent source of protein. In comparison to other pulses, it is highly digestible (Samiullah *et al*., 1982) [4] and free of the flatulent effects. Additionally, through atmospheric nitrogen fixation through their root nodules, it plays a crucial role in maintaining and improving the fertility of the soil. On the base of greengram, nodule formation with Rhizobium microorganisms fixes about 35 kg of atmospheric nitrogen per hectare (Gupta and Prasad, 1982) [5]. This nitrogen is then available to the growing cereal plants in both blended and rotation cropping, which is ultimately beneficial to the next crop (Yadav, 1992) [6].

Although fertilizers are an expensive investment, they are crucial to ensuring greater returns. The most crucial element in ensuring a better and more profitable return is using fertilizers sensibly, using the appropriate technique, at the appropriate time. P is the most crucial nutrient, after N. Across all soil types, its absence is usually the single most significant factor in low pulse yield. It's necessary for nucleic acids and proteins to function correctly. Because N and P fertilizers are becoming more and more expensive every day, it is necessary to apply a few costly fertilizers, such as rhizobium and phosphate-solubilizing microorganisms, among others.

The most significant contribution to increased N and P availability comes from biofertilizers like rhizobium and phosphate-solubilizing microorganisms (PSB), which increase the crop's optimal phosphorus availability and organic nitrogen fixation, respectively. When phosphatic rocks are utilized in crop production, these microorganisms can also multiply. Phosphorus-solubilizing microorganisms have been demonstrated to function better through co-inoculation with mycorrhizae and other beneficial microorganisms (Khan *et al*., 2009) [7].

Phosphorus-solubilizing bacteria (PSB) inoculation: Inorganic phosphorus can be dissolved from insoluble resources like tricalcium phosphate, ferric aluminum and magnesium phosphate, rock phosphate, and bone meal by certain heterotrophic microbes and fungi. When seeds are injected with microbial biofertilizers, Pseudomonas striata, Bacillus polymixa, Aspergillus awamori, Penicillium digitatum, and other significant phosphorus solubilizing micro-organisms (PSB) can provide 30 kg P per ha of super phosphate phosphorus (Gaur, 1990) [8].

Material and Methods

A field experiment was conducted during rabi season of 2022-23 on loamy sand of in the rural area of Kanpur district of Mandhana, located 10 km from Kanpur in Uttar Pradesh Implication of organic manures on the yield, growth, and quality of green gram under organic farming (*Vigna radiata* L.).The soil was normal in pH of 7.62, electrical conductivity (EC) of 0.25 dSm^{-1}, organic carbon content of 0.42%, and available nutrients including nitrogen (N), phosphorus (P), and potassium (K) at levels of 216.10, 19.12, and 149.30 kg ha^{-1}, respectively. The experiment was laid out during summer season of 2023-24. The experiment consisted of 12 treatment combinations, Levels of phosphorus (Control, 25 kg ha^{-1} P_2O_5, 45 kg ha^{-1} P_2O_5, 60 kg ha^{-1} P_2O_5) Biofertilizer (PSB, Rhizobium PSB + Rhizobium) k Design (RBD) with three replications. Data were gathered on five plants chosen from each plot.

Results and Discussion

Growth Parameters

The results demonstrate that control was attained throughout the entire crop growth cycle, with the maximum plant height exceeding 20 kg P_2O_5 per ha. In contrast to 40 kg P_2O_5, 20 kg P_2O_5, and the control at 30 and 45 days after planting, application of 60 kg P_2O_5 per hectare resulted in noticeably taller plants. At every stage of crop growth, the inoculation of biofertilizer had a significant impact on plant height. With increasing rates of phosphorus application, Luikham *et al*. (2005) [10] observed a marked improvement in plant height and number of branches per plant of greengram. Seed inoculation with PSB + Rhizobium being at par with seed inoculated with Rhizobium at 15 DAS, 60 DAS, and harvesting. The aforementioned findings also align with those of Meena *et al*. (2006) [12], Biswas and Patra (2007) [13], and Karwasra *et al*. (2006) [11]. On the other hand, seed inoculated with PSB plus Rhizobium at 30 and 45 days after sowing showed a noticeably taller plant than seed inoculated with Rhizobium and PSB alone. It follows that seed treated with PSB + Rhizobium is significantly superior to seed treated with PSB in terms of plant height, while seed treated with Rhizobium is on par with seed treated with PSB. Others, including Singh and Kumar (2016) [16], Dongare *et al*. (2016) [15], and Hussain *et al*. (2011a) [14], have reported findings that are similar to these. The interaction effect between different phosphorus levels and seed inoculation with biofertilizers was found to be non-significant at all stages of crop growth.

The maximum number of branches per plant increased in a period of 15 to 30 days, after which the rate of increase slowed to 30 to 60 days and then somewhat decreased at the harvesting stage. In all stages of crop growth, the data in Table 2 clearly demonstrate that applying 60 kg P_2O_5 per ha significantly increased the number of branches per plant compared to the control. Bairwa *et al*. (2012) [17] held comparable views. On the other hand, at all stages of crop growth, the application of 60 kg P_2O_5 per ha was equivalent to 40 kg P_2O_5 per ha. The findings indicate that although the 40 kg P_2O_5 per ha treatment and the 60 kg P_2O_5 per ha application were similar, the 60 kg P_2O_5 per ha application produced significantly more branches per plant than the 20 kg P_2O_5 per ha application and control throughout the entire crop growth cycle. In all stages of crop growth during the experiment, the number of branches per plant was significantly impacted by the inoculation of biofertilizer. Rhizobium + PSB seed inoculation is equivalent to Rhizobium seed inoculation at 60 DAS. At 15, 30, 45, and the harvest stage of crop growth, however, seed inoculation with PSB + Rhizobium recorded a noticeably higher number of branches per plant than seed inoculation with Rhizobium and PSB.

Although the application of 60 kg P_2O_5 per ha produced significantly more nodules per plant than the control (20 kg P_2O_5 per ha), it was found to be comparable to 40 kg P_2O_5 per ha. When seed was inoculated with PSB + Rhizobium and was on par with Rhizobium, the greatest number of nodules per plant was observed. Yadav and Yadav (2011) [18] and Hussain *et al*. (2011a) [14] have also published findings that are similar. The findings of a previous study by Kumpawat *et al*. (2008) [19], Patel *et al*. (2013) [20], and Mir *et al*. (2013) [21] are supported by the results of this investigation. When compared to seed inoculated with Rhizobium and PSB alone, seed inoculated with PSB + Rhizobium yielded a noticeably greater number of nodules per plant. The number of nodules per plant was found to be unaffected by the interaction between different phosphorus levels and seed inoculation with biofertilizers.

The greatest increase in dry matter accumulation per plant was observed between 15 and 30 DAS; after that, the rate of increase was gradual and decreased slightly by harvest. The data presented in Table 4.4 makes it evident that applying 60 kg of P_2O_5 per hectare greatly increases the amount of dry matter accumulated by each plant compared to the control during every stage of crop growth. Throughout all stages of crop growth, the application of 60 kg P_2O_5 per ha is equivalent to 40 kg P_2O_5 per ha. Luikham *et al*. (2005) [10], Islam *et al*. (2013a) [22], Patel *et al*. (2013) [23], and Singh *et al*. (2018b) [24] have all reported findings that are similar to these. Conclusion: During all stages of crop growth, the application of 60 kg P_2O_5 per ha produced significantly higher dry matter accumulation per plant than the application of 20 kg P_2O_5 per ha and the control. However, the application of 60 kg P_2O_5 per ha was comparable to the application of 40 kg P_2O_5 per ha. At 60 DAS and harvest stage, the maximum dry matter accumulation per plant was observed in the cases where seed was inoculated with PSB + Rhizobium. Significantly higher dry matter accumulation plant^{-1} was observed at 15, 30, 45, and 60 days after seed inoculation with PSB + Rhizobium during crop growth. At 15, 30, 45, 60 DAS, and harvest, it was discovered that the interaction effect between different phosphorus levels and seed inoculation with biofertilizers was not significant for dry matter accumulation plant^{-1}.

Table 1: Plant height (cm) as affected by phosphorus levels and biofertilizer at successive stage of crop growth

S. N	Treatments	15 DAS	30 DAS	45 DAS	60 DAS	At harvest
a.	**Phosphorus levels (kg ha^{-1})**					
1.	Control	9.90	20.50	26.20	30.80	38.33
2.	20	11.90	26.40	33.90	39.90	45.17
3.	40	12.50	30.30	38.40	46.40	49.14
4.	60	12.90	32.00	41.50	47.30	51.76
	SEm±	0.249	0.613	0.785	0.886	1.034
	C.D. (P=0.05)	0.716	1.764	2.258	2.549	2.976
b.	**Biofertilizer**					
1.	PSB	10.50	22.90	29.00	38.40	43.41
2.	*Rhizobium*	12.20	27.40	35.60	41.00	46.10
3.	PSB + *Rhizobium*	12.70	31.60	40.40	43.90	48.79
	SEm±	0.216	0.613	0.680	0.767	0.896
	C.D. (P=0.05)	0.620	1.764	1.956	2.207	2.578

Table 2: Number of branches per plant as affected by phosphorus levels and biofertilizers at successive stage of crop growth

S. N	Treatments	15	30	45	60	At harvest
a.	**Phosphorus levels (kg ha^{-1})**					
1.	Control	2.20	4.67	6.40	8.00	8.40
2.	20	2.50	5.71	8.00	9.90	10.20
3.	40	2.78	6.67	9.20	11.17	11.60
4.	60	2.92	6.95	9.60	11.73	12.20
	SEm±	0.056	0.133	0.179	0.233	0.235
	C.D. (P=0.05)	0.161	0.382	0.515	0.671	0.676
b.	**Biofertilizer**					
1.	PSB	2.30	5.52	7.10	9.10	9.20
2.	*Rhizobium*	2.60	6.00	8.50	10.50	11.00
3.	PSB + *Rhizobium*	2.90	6.48	9.30	11.00	11.60
	SEm±	0.049	0.115	0.155	0.202	0.203
	C.D. (P=0.05)	0.140	0.331	0.446	0.581	0.585

Table 3: Root studies as affected by phosphorus levels and biofertilizers at successive stage of crop growth

S. N	Treatments	Root length (Cm)	No. of nodules plant^{-1}	Root dry weight (g)	Root volume (Cm3)	Root spread (Cm2)
a.	**Phosphorus levels (kg ha^{-1})**					
1.	Control	13.90	37.60	0.35	1.78	1.65
2.	20	14.20	40.80	0.38	1.84	1.67
3.	40	15.10	43.20	0.43	2.00	1.70
4.	60	15.60	45.00	0.44	2.10	1.74
	SEm±	0.270	0.953	0.008	0.047	0.033
	C.D. (P=0.05)	0.776	2.742	0.022	0.136	0.094
b.	**Biofertilizer**					
1.	PSB	14.00	38.15	0.36	1.80	1.64
2.	*Rhizobium*	14.80	42.35	0.41	1.95	1.68
3.	PSB + *Rhizobium*	15.30	44.45	0.43	2.04	1.75
	SEm±	0.234	0.825	0.007	0.041	0.028
	C.D. (P=0.05)	0.672	2.375	0.019	0.118	0.081

Table 4: Dry matter accumulation per plant (g) as affected by phosphorus levels and biofertilizers at successive stage of crop growth

S. N	Treatments	15 DAS	30 DAS	45 DAS	60 DAS	At harvest
a.	**Phosphorus levels (kg ha^{-1})**					
1.	Control	0.95	2.60	6.90	9.90	10.20
2.	20	1.10	3.10	7.80	10.90	11.50
3.	40	1.26	3.70	8.20	11.80	12.10
4.	60	1.33	3.80	8.70	12.40	12.80
	SEm±	0.029	0.067	0.177	0.230	0.278
	C.D. (P=0.05)	0.082	0.192	0.510	0.663	0.801
b.	**Biofertilizer**					
1	PSB	0.98	2.70	6.70	10.10	10.20
2	*Rhizobium*	1.20	3.30	8.10	11.55	12.10
3	PSB + *Rhizobium*	1.30	3.90	8.90	12.10	12.65
	SEm±	0.025	0.058	0.153	0.200	0.241
	C.D. (P=0.05)	0.071	0.166	0.441	0.574	0.693

Conclusion
The following conclusions are drawn from the current study, which was carried out over the course of two consecutive years and may be helpful to scientists and farmers. For increased greengram growth and yield, a combination of PSB + Rhizobium seed inoculation and 60 kg P_2O_5 applied per hectare proved to be most effective.

References

1. Swaminathan MS. Improving pulse production and productivity challenges aheads. Pulse Crops Newsletter. 1981;1(2):25.
2. Kachroo P. Pulse crop of India. New Delhi: ICAR; c1970. p. 148.
3. Anonymous. Directorate of economics and statistics, statistics Division 2018; c2018.
4. Samiullah, Akhtar M, Afridi MMRK, Khan MMA. Effect of basal nitrogen and phosphorus on yield characteristics of summer moong (*Vigna radiata* var. t-44). IJPP; c1982.
5. Gupta B, Prasad M. Mechanism of salinity tolerance in plants: physiological, biochemical, and molecular characterization. Int. J Genomics; c1982.
6. Yadav DS. Pulse Crop. New Delhi: Kalyani Publishers; c1992. p. 14-21.
7. Khan KS, Joergensen RG. Changes in microbial biomass and phosphorus fractions in biogenic household waste compost amended with inorganic phosphatic fertilizers. Bioresour Techno. 2009;100:303-309.
8. Gaur AC. I. New Delhi: Omega Scientific Publication; c1990. p. 176.
9. Gajera RJ, Khafi HR, Raj AD, Yadav V, Lad AN. Effect of phosphorus and bio-fertilizer on growth yield and economics of summer green gram. Agriculture Update. 2014;9(1):98-102.
10. Luikham E, Lhungdiam J, Singh AI. Influence of sources and levels of phosphorus on growth and yield of green gram (*Vigna radiata* (L.) Wilczek). Legume Res. 2005;28(1):59-61.
11. Karwasra RS, Kumar Y, Yadav AS. Effect of phosphorus and sulphur on green gram (*Phaseolus radiatus*). Haryana J Agron. 2006;22(2):164-165.
12. Meena KR, Dahama AK, Reager ML. Effect of phosphorus and zinc fertilization on growth and quality of clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.]. Ann Agric Res New Ser. 2006;27(3):224-226.
13. Biswas A, Patra AP. Study on the effect of phosphorus, Vesicular Arbuscular Mycorrhizae (VAM) and Phosphate Solubilizing Bacteria (PSB) on the performance of summer greengram. In: National Symposium on Legumes for Ecological Sustainability: Emerging Challenges and Opportunities; 2007 Nov 3-5; Indian Institute of Pulses Research, Kanpur; c2007. p. 180-187.
14. Hussain N, Hasan B, Habib R, Lekh C, Ali A, Hussain A. Response of biofertilizers on growth and yield attributes of black gram (*Vigna mungo* L.). Int J Curr Res. 2011;2(1):148-150.
15. Dongare DM, Pawar GR, Murumkar SB, Chavan DA. Study the effect of different fertilizer and bio-fertilizer levels on growth and yield of summer greengram (*Vigna radiata* (L.) Wilczek). Int. J Agric. Sci. 2016;12:151-157.
16. Singh B, Kumar R. Effect of integrated nutrient management on growth, yield and nutrient uptake of clusterbean (*Cyamopsis tetragonoloba*) under irrigated conditions. Agric. Sci. Dig. 2016;36(1):35-39.
17. Bairwa RK, Nepalia V, Balai CM, Upadhyay B. Effect of phosphorus and sulphur on yield and economics of summer green gram (*Vigna radiata*). Madras Agric. J. 2012;99(7/9):523-525.
18. Yadav BK. Interaction effect of phosphorus and sulphur on yield and quality of clusterbean in typic haplustept. J Agric Sci. 2011;7(5):556-560.
19. Kumpawat BS, Manohar S. Effect of rhizobium inoculation, phosphorus and micronutrients on nodulation and protein content of gram. Madras Agric J. 2008;81:630-631.
20. Patel HR, Patel HF, Maheriya VD, Dodia IN. Response of kharif greengram (*Vigna radiata* (L.) Wilczek) to sulphur and phosphorus fertilization with and without biofertilizer application. The Bioscan. 2013;8(1):149-152.
21. Mir AH, Lal SB, Salmani M, Abid M, Khan I. Growth, yield and nutrient content of blackgram (Vigna mungo) as influenced by levels of phosphorus, sulphur and phosphorus solubilizing bacteria. SAARC J Agri. 2013;11(1):01-06.
22. Islam M, Akmal M, Khan MA. Effect of phosphorus and sulphur application on soil nutrient balance under chickpea (*Cicer arietinum*) monocropping. Romanian Agric Res. 2013;30:223-232.
23. Patel HR, Patel HF, Maheriya VD, Dodia IN. Response of kharif greengram (*Vigna radiata* (L.) Wilczek) to sulphur and phosphorus fertilization with and without biofertilizer application. The Bioscan. 2013;8(1):149-152.

24. Singh R, Pratap T, Singh D, Singh G, Singh AK. Effect of phosphorus, sulphur and biofertilizers on growth attributes and yield of chickpea (*Cicer arietinum* L.). J Pharmacogn. Phytochem. 2018;7:3871-3875.