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Effect of phosphate rich organic manure on growth, yield and quality of greengram (*Vigna radiata* L.)

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Abstract
A field investigation entitled "Effect of phosphate rich organic manure (PROM) on growth, yield and quality of greengram" was conducted in *kharif* season of 2024- 2025 at Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment was conducted in randomized block design with seven treatments replicated 3 times. Results revealed that treatment T_3 (100% P2O5 through SSP) recorded significantly higher all the growth contributing characters *viz.*, plant height (56.99 cm), no. of functional leaves plant^{-1} (11.46), leaf area plant^{-1} (10.62 dm^2), no. of root nodules plant^{-1} (28.33) and dry matter plant^{-1} (24.33 g). Similarly, all the yield contributing characters no. of pods plant^{-1} (27.25), no. of seeds pod^{-1} (10.61), wt. of pods plant^{-1} (13.31 g), wt. of seeds plant^{-1} (12.89 g) and 1000 seed weight (42.31 g) were recorded significantly maximum under T_3 treatment (100% P2O5 through SSP). The highest grain yield (1323 kg ha^{-1}), straw yield (1996 kg ha^{-1}), biological yield (3319 kg ha^{-1}), harvest index (39.86%) is also recorded by the T_3 treatment (100% P2O5 through SSP).

Keywords: Greengram, P_2O_5, growth, yield, nutrient, SSP, prom, phosphorous

1. Introduction
In India, pulses or food legumes are second only to cereals in terms of both production and consumption. They are a vital part of the human diet, supplying essential nutrients such as energy, protein, vitamins, and minerals. Apart from their nutritional benefits, pulses play a crucial role in Indian agriculture. Their root nodules can fix atmospheric nitrogen, contributing to improved soil fertility. With characteristics like deep rooting systems, efficient ground cover, drought resistance, and the ability to prevent soil erosion, pulses are rightly referred to as the "Marvel of Nature."

Greengram (mungbean) is unique among pulse crops in its ability to be grown year around, making it adaptable to all three principal cropping seasons. Commonly referred to as *Vaishakhi Mug*. Greengram offers numerous advantages. As reported by (Daina*vi*zadeh and Mehranzadeh, 2013) [3], mungbean seeds comprise 20-24% protein, 9.4% moisture, 2.1% oil, 2.05% lipids, 6.4% fibre, and provide 343.5 kcal of energy 100 grams^{-1}. The total area under pulse cultivation stands at 27,528 thousand hectares, with an output of 252.38 Lakh metric tonnes (LMT), reflecting an increase of 9.92 LMT over the previous year's 242.46 LMT. Specifically, during 2023-2024, the area under greengram cultivation was 31.49 lakh hectares, yielding 3.10 million tonnes.

Phosphorus is primarily concentrated in the reproductive parts of plants, where it plays a crucial role in seed formation. A lack of phosphorus can result in restricted plant growth, as seeds need sufficient amounts of this nutrient for proper development (Muindi, 2019) [7]. Thus, phosphorus is vital not only for seed filling but also for the overall growth of the plant, greatly contributing to improved crop development (Sahrawat and Ismail, 1990) [9]. Additionally, phosphorus helps regulate the movement of photosynthates from source tissues to reproductive organs (Cheema *et al.*, 2001) [2].

Phosphate Rich Organic Manure (PROM) is a type of fertiliser that acts as a substitute for traditional fertilisers such as diammonium phosphate (DAP) and single super phosphate (SSP). It is created by co-composting finely ground high grade rock phosphate, with about 80% of its

particles smaller than 54 microns and containing approximately 32% P_2O_5 (± 2%). The preparation of PROM necessitates the use of high-quality organic materials with a carbon to nitrogen (C:N) ratio of 20:1. Inadequately decomposed organic matter can compete with plants for nutrients and may also promote the activity of harmful termites (Aechra *et al*., 2021) [1].

2. Materials and Methods

A field investigation entitled "Effect of phosphate rich organic manure (PROM) on growth, yield and quality of greengram" was conducted in *kharif* 2024 - 2025 at Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment consists of 7 treatments *viz*., T_1: Absolute control; T_2: Control (No P_2O_5); T_3: 100% P_2O_5 through SSP; T_4: 100% P_2O_5 through Phosphate Rich Organic Manure (PROM); T_5: 75% P_2O_5 through Phosphate Rich Organic Manure (PROM) + 25% P_2O_5 through SSP; T_6: 50% P2O5 through Phosphate Rich Organic Manure (PROM) +50% P2O5 through SSP; T_7: 25% P_2O_5 through Phosphate Rich Organic Manure (PROM) + 75% P_2O_5 through SSP; Nitrogen applied through Urea; Phosphorus was applied through single super phosphate and PROM; PSB seed treatment was done to treatment T_2 to T_7.

The experiment was laid out in randomized block design (RBD) with three replications. Line sowing of greengram seeds was done at spacing of 30 cm between rows and 10 cm between plants. The soil was clay in texture, low in available nitrogen (202.57 kg ha^{-1}), medium in available phosphorus (19.10 kg ha^{-1}) and high in potassium (349.65 kg ha^{-1}). The mean available nitrogen, phosphorus and potassium content in soil after harvest of greengram crop were 216.94, 17.88 and 318.98 kg ha^{-1} respectively. The soil was slightly alkaline in reaction (pH 8.14) with medium in organic carbon content (0.51%). The recommended dose of fertilizer of greengram is 20: 40:00 N: P_2O_5: K_2O kg ha^{-1}.

3. Results and Discussion

3.1 Growth Parameters

The information related to plant height (cm), no. of functional leaves, dry matter $plant^{-1}$, no. of root nodules and leaf area (dm^2) of greengram as influenced by various treatments presented in Table 1.

Table 1: Effect of phosphate rich organic manure (PROM) on growth contributing characters of greengram as influenced by different treatment

Tr. No.	Treatment	Growth contributing Characters				
		At harvest			At flowering	60 DAS
		Plant height (cm)	No. of functional leaves $plant^{-1}$	Dry matter $plant^{-1}$ (g)	No. of root nodules $plant^{-1}$	Leaf area plant (dm^2)
T_1	Absolute control	42.98	7.96	18.76	22.12	7.36
T_2	Control (No P2O5)	48.89	8.35	19.50	23.62	7.75
T_3	100% P2O5 through SSP	56.99	11.46	24.33	28.33	10.62
T_4	100% P2O5 through Phosphate Rich Organic Manure (PROM)	49.29	8.94	20.32	23.91	8.26
T_5	75% P2O5 through Phosphate Rich Organic Manure (PROM) + 25% P2O5 through SSP	50.67	9.23	21.29	24.29	8.53
T_6	50% P2O5 through Phosphate Rich Organic Manure (PROM) +50% P2O5 through SSP	51.58	9.68	21.96	24.55	8.92
T_7	25% P2O5 through Phosphate Rich Organic Manure (PROM) + 75% P2O5 through SSP	54.97	10.79	22.88	26.65	9.97
	S.E. ±	1.56	0.48	0.76	1.20	0.43
	C.D.at 5%	4.82	1.48	2.35	3.69	1.34
	General mean	50.77	9.49	21.29	24.78	8.77

The plant height (cm), no. of functional leaves, dry matter $plant^{-1}$, and leaf area $plant^{-1}$ at 30 DAS was found non-significant. The plant height (cm), no. of functional leaves, dry matter $plant^{-1}$ at harvest, no. of root nodules at flowering and leaf area $plant^{-1}$ at 60 DAS were significantly recorded higher by T_3 treatment i.e. 100% P_2O_5 through SSP (56.99 cm, 11.46, 24.33 (g), 28.33 and 10.62 dm^2 respectively) and it was at par with T_7 treatment i.e. 25% P_2O_5 through Phosphate Rich Organic Manure (PROM) + 75% P_2O_5 through SSP recorded (54.97 cm, 10.79, 22.88 (g), 26.65 and 9.97 dm^2) respectively. While significantly lower plant height (cm), no. of functional leaves, dry matter $plant^{-1}$ (g), no. of root nodules at flowering and leaf area $plant^{-1}$ (dm^2) recorded by treatment T_1 (absolute control) were (42.98 cm, 7.96, 18.76 g, 22.12 and 7.36 dm^2) respectively (Table 1). Comparable findings have been documented by Singh *et al.* (2018) [11], Rajput and Rajput (2017) [8], Meshram *et al.* (2024) [5] and Das (2016) [4].

3.2 Yield contributing characters

The information related to no. of pods $plant^{-1}$, no. of seeds pod^{-1}, wt. of pods $plant^{-1}$, wt. of seeds $plant^{-1}$ and 1000 seed weight (g) of greengram as influenced by various treatments presented in Table 2.

The yield contributing characters *viz*., no. of pods $plant^{-1}$, no. of seeds pod^{-1}, weight of pods $plant^{-1}$, weight of seeds $plant^{-1}$ and 1000 seed weight (g) were 27.25, 10.61, 13.31 12.89 and 42.31 (g) significantly higher recorded by the T_3 treatment i.e. 100% P_2O_5 through SSP and it was at par with treatment T_7 i.e. 25% P_2O_5 through Phosphate Rich Organic Manure (PROM) + 75% P2O5 through SSP recorded 26.55, 10.18, 12.86, 12.67 and 42.02 (g) respectively. Similarly, significantly minimum values of no. of pods $plant^{-1}$, no. of seeds pod^{-1}, weight of pods $plant^{-1}$, weight of seeds $plant^{-1}$ and 1000 seed weight (g) by treatment T_1 i.e. absolute control recorded 22.11, 8.37, 11.18, 10.85 and 39.96 (g) respectively in Table 2. Immediate availability of soluble phosphorus from SSP, which plays a crucial role in pollen development, fertilization efficiency, flower initiation, effective pods set and seed setting within pods. Phosphorous is important for pollen tube growth, leading to successful fertilization and higher seed formation. In contrast, PROM releases phosphorus slowly due to microbial mineralisation, which may delay nutrient availability during critical reproductive stages compared to SSP. Similar results also showed by Singh *et al.* (2015) [10] and Yadav *et al.* (2021) [12] that increased levels of SSP significantly increased seed number pod^{-1}.

Table 2: Effect of phosphate rich organic manure (PROM) on No. of pods plant^{-1}, No. of seed pod^{-1}, wt. of pods plant^{-1}, wt. of seeds plant^{-1} and 1000 seed weight at harvest of greengram as influenced by different treatments

Tr. No.	Treatment	No. of pods plant^{-1}	No. of seeds pod^{-1}	Wt. of pods plant^{-1} (g)	Wt. of seeds plant^{-1} (g)	1000 seed weight (g)
T_1	Absolute control	22.11	8.37	11.18	10.85	39.96
T_2	Control (No P2O5)	22.91	8.79	11.76	11.71	40.32
T_3	100% P through Single Super Phosphate (SSP)	27.25	10.61	13.31	12.89	42.31
T_4	100% P through Phosphate Rich Organic Manure (PROM)	24.30	9.39	12.22	11.95	40.97
T_5	75% P through Phosphate Rich Organic Manure (PROM) and 25% P through Single Super Phosphate (SSP)	25.01	9.71	12.41	12.01	41.64
T_6	50% P through Phosphate Rich Organic Manure (PROM) and 50% P through Single Super Phosphate (SSP)	25.31	9.94	12.62	12.15	41.75
T_7	25% P through Phosphate Rich Organic Manure (PROM) and 75% P through Single Super Phosphate (SSP)	26.55	10.18	12.86	12.67	42.02
	SE m±	0.58	0.17	0.20	0.15	0.79
	CD (P=0.05)	1.79	0.52	0.62	0.50	NS
	General mean	24.77	9.57	12.33	12.03	41.28

3.3 Yield studies

The information related to seed, straw and biological yield of greengram as influenced by various treatments presented in Table 3.

Significantly higher seed yield, straw yield and biological yield kg ha^{-1} was recorded by T_3 treatments (100% P_2O_5 through SSP) recorded 1323, 1996 and 3319 kg ha^{-1} and it was at par with treatment T_7 (25% P_2O_5 through PROM + 75% P_2O_5 through SSP) recorded 1270, 1918 and 3188 kg ha^{-1} respectively the seed, straw and biological yield. Whereas significantly minimum seed, straw and biological yield was recorded by T_1 treatment (Absolute control) *viz*., 615, 1253 and 1868 kg ha^{-1} respectively. These results are consisted with those reported by Yadav *et al.*, (2021) [12], More *et al.* (2024) [6] and Das (2016) [4].

Table 3: Effect of phosphate rich organic manure (PROM) on seed, straw and biological yield of greengram as influenced by different treatment

Tr. No.	Treatment	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})
T_1	Absolute control	615	1253	1868
T_2	Control (No P2O5)	855	1418	2273
T_3	100% P through Single Super Phosphate (SSP)	1323	1996	3319
T_4	100% P through Phosphate Rich Organic Manure (PROM)	1029	1582	2611
T_5	75% P through Phosphate Rich Organic Manure (PROM) and 25% P through Single Super Phosphate (SSP)	1070	1644	2714
T_6	50% P through Phosphate Rich Organic Manure (PROM) and 50% P through Single Super Phosphate (SSP)	1148	1735	2883
T_7	25% P through Phosphate Rich Organic Manure (PROM) and 75% P through Single Super Phosphate (SSP)	1270	1918	3188
	SE m±	29.92	48.13	95.26
	CD (P=0.05)	92.20	148.31	293.55
	General mean	1044.29	1649.31	2693.54

4. Conclusion

The treatment receiving 100% phosphorus through Single Super Phosphate (T_3) exhibited markedly better growth and yield performance, reflected in greater plant height, higher number of functional leaves plant^{-1}, dry matter accumulation, no. of root nodules plant^{-1}, leaf area plant^{-1}, higher seed and straw yield which was found at par with treatment T_7 (25% P through Phosphate Rich Organic Manure combined with 75% P through SSP). However, the research above is based on a single season of research.

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