Original Research Article

Influence of organic nutrients on growth and yield of summer Greengram (*Phaseolus radiata* L.)

Abstract

A field experiment was conducted during *Zaid* 2023 at Shuats Model Organic Farm, Department of Agronomy, Shuats, Prayagraj (U.P). The soil was sandy loam in texture, moderately basic in reaction (pH 7.8), medium in available N (249.50 kg/ha), medium in available phosphorus (38.2 kg/ha), available potassium (240.7 kg/ha), and available Organic Carbon (0.662 %). The treatment consists of 3 different manures farm yard manure, vermicompost, goat manure and 3 different sources of foliar spraying Fish amino acid, Panchagavya and Seaweed (*Kappaphycus alvarezii)* sap. Whose effect was observed on Greengram. The experiment was laid out in a randomized block design with nine treatments replicated thrice. The result showed that growth parameters viz, plant height (42.09 cm), number of nodules (22.22/plant) and dry weight (19.35g/plant) yield attributes like effective seed/pod (9.68), pods/plant (11.05), test weight (37.17 g), seed yield (1633.54 kg/ha), stover yield (3323.55 kg/ha). Highest gross return (Rs. 1,55,285.42/ha), net return (Rs. 1,00,685.42 /ha) and benefit: cost ratio (1.84) was recorded superior with application T9 (FYM 5 t/ha + 7.5 % K sap).

From the results, it can be concluded that application of (FYM 5 t/ha + 7.5 % K sap) T9 in greengram has recorded highest grain yield, gross return, net return and benefit cost ratio.

Key words: Green gram, Vermicompost, FYM, Goat Manure, Seed Yield, Panchagavya, Seaweed sap, Fish Amino Acid.

INTRODUCTION

Growing Greengram (*Phaseolus radiata* L.) as a catch crop in between the *Zaid* and *kharif* seasons is one of India's major *Zaid* pulse crops. In India, it is a significant conventional pulse crop. A green gram has 334 calories per 100 g of weight. Its high nutritional content 24.0% crude protein, 1.3% fat, 56.6% carbohydrates, 3.5% minerals, 0.43% lysine, 0.1% methionine, and 0.04% tryptophan is well-known. Because of its short growing time, which allows it to fit into intercropping systems with diverse crops, high tonnage capacity, and exceptional nutritional properties for food, feed, and forage, it has a wide range of adaptations. In underdeveloped nations like India, pulses are frequently referred to as "poor man's meat" since they are less expensive than meat (Patel *et al*., 2020). India is the major producer of green gram in the world, and it is grown in almost all the states. It is grown on about 40.38 lakh hectares with a total production of 31.5 lakh tonnes with a productivity of 783 kg/ha and contributes 11 % to the total pulse production in the year 2021-22. Some of the states like Uttar Pradesh (0.30 lakh/ ha) are the major producers of green gram in India (GOI, 2021).

The soil application of organic manures and liquid organic foliar sprays at flower initiation and 15 days after flowering (DAF) significantly enhances the seed yield and seed quality parameters of greengram. Use of organic manures alone or in combination with liquid organic manures will help to improve soil physico-chemical properties and the effective utilization of applied organic manures for improved seed yield and seed quality. Sharma *et al*. (2012) reported that FYM will decompose in moist soil to improve the soil structure and release the nutrients contained in it in soluble form for the growth of the crop. Vermicompost, also known as vermi-compost, is a mixture of bedding materials, decomposing vegetable, or food waste, and Vermicast that is produced by utilizing different species of worms, primarily red wigglers, white worms, and earthworms (Singh *et al.* 2022). Goat manure dung is a great soil conditioner because of its high nitrogen content. Enhancing the texture of the soil allows more oxygen to reach the roots and nodules, promoting efficient water consumption and plant growth (Kumar *et al.* 2003).

Foliar spraying concentrates on the above-ground areas, where nutrients are required and fast absorption is aided. Foliar fertilization may be a more effective method of making up for the decrease in root activity and nutrient uptake, particularly during reproductive stages. fine spray, drip watering, and top dressing. Fish protein dramatically increases the amount of organic matter in the soil, may quickly encourage the spawning of soil microorganisms, greatly activates soil nutrients, and increases soil fertility. Effects of using fish amino acids topically to boost greengram yield and growth (Setia *et al*. 2023). An organic compound called Panchagavya can strengthen plant systems by fostering development and immunity. The application of Panchagavya foliar spray considerably enhances the quantity of pods on each green gram plant, hence directly contributing to larger crop production (Singh *et al.* 2022). Seaweed liquid fertilizers are useful for achieving higher agricultural production, because the extract contains

growth promoting hormones, IAA. IBA, Cytokinin's, Gibberellins, trace elements, vitamins, amino acids, antibiotics, and micronutrients (Zodape *et al.* 2008). Seaweed extracts from Kappaphycus alvarezii have been found to increase the yield of Vigna sinensis and Phaseolus radiata (Sivasankari *et al.* 2006, Zodape *et al.* 2010)

Any improvement to the agricultural system that raises output needs to be environmentally benign and strengthen the system's sustainability. The indiscriminate use of chemical fertilizers and pesticides damages soil flora and fauna and raises important issues related to soil health, lower input use efficiency, and fertilizer use efficiency in crops. Due to these reasons the farmers are being compelled gradually day by day to turn towards various options like organic manures, bio-stimulants, growth regulators, etc.

MATERIALS AND METHOD

A field experiment was carried out in alluvial soil at the Crop Research Farm of the Department of Agronomy, SHUATS, Prayagraj, U.P., during the Zaid season of 2023. The sandy loam soil of the experimental plot had a virtually neutral soil response (pH 7.8), 0.618 ds/m electrical conductivity, 0.662% organic carbon, 249.5 kg/ha of available nitrogen, 240.8 kg/ha of potassium, and 38.7 kg/ha of accessible phosphorus. On April 19, 2023, greengram seeds (Virat IPM 205-7) were planted with a 25 cm x 10 cm spacing. Nine treatment combinations and three replications were used in the randomized block design trial. To apply organic manure as a spreading method, 4-5 cm-deep furrows were dug along the seed rows using a hand hoeing. Goat manure, FYM, and vermicompost were the sources of nutrients. Ten days after sowing, the gaps were closed by transplanting once germination occurred. Where necessary, seedlings were trimmed out to maintain a 25 cm by 10 cm spacing. In order to reduce crop, weed competition, manual weeding was carried out between 15 and 30 days following seeding with the use of khurpi. Organic nutrients were administered topically at intervals of 15 and 30 DAS. June 25, 2023, saw the harvest of the crop. At regular intervals from germination to harvest, plant growth parameters such as plant height (cm) and dry weight (g/plant) were assessed. At harvest, yield metrics such as pods/plant, seeds/pod, test weight (g), seed yield (kg/ha), stover yield (kg/ha), and harvest index (%) were measured. Analysis of variance (ANOVA), as it relates to randomized block design, was used to statistically examine the observed data (Gomez and Gomez,).

Results and Discussions

Growth parameter

The data of growth parameter are presented in Table 1. Significantly highest plant height (42.09 cm) was recorded with the application of (FYM 5 t/ha + 7.5 % K sap) in treatment 9. However, treatments 8 (39.79 cm) were statistically at par with the highest. This might be due to application of seaweed K sap, which increases the growth and development capacity and results in the early growth of seedlings. growth promoting hormones, IAA. IBA, Cytokinin's, Gibberellins, trace

elements, vitamins, amino acids, antibiotics, and micronutrients (Patel *et al.* 2008 and Chaudhary *et al.* 2008). Hence, in this treatment, number of nodules are significantly highest in treatment 9 with FYM 5 t/ha + 7.5 % K sap (22.22) significant increase in nodule number over control was observed at flowering due to foliar spray of 7.5 % K sap while nodule dry weight improved significantly over due to K-sap 7.5% at all the concentrations These results are in conformity with (Pramanick *et al.* 2013). The highest nodule dry weight was synthesized due to foliar spray of 7.5% K-sap. Hence, in this treatment. In treatment 9 (FYM 5 t/ha + 7.5 % K sap) recorded significantly highest dry weight (19.35 g) which was statistically at par with treatments 8 (18.12 respectively). Foliar application of seaweed saps had significantly influenced on the growth and development of greengram and increase in weight of plant. This might be due to presence of growth promoting hormone in seaweed extract attributed to the activation of cell division and cell elongation in the axillary buds which promote and increased number of branches. These results are in close vicinity with the findings of (Patel *et al*. 2008 and Akhila *et al.* 2017). Interaction effect of organic manures and bioenhancers on dry weight of plant was found to be significant for greengram.

Yield attributes

The data pertaining to yield-attributing characters are presented in Table 2. The maximum number of pods/plant (11.05) was recorded with the application of (FYM 5 t/ha + 7.5 % K sap)which was found to be statistically at par with treatment 5, 6, 7 and 8 (10.08, 10.44, 10.78, 10.96). Significantly higher number of seeds/pod (9.68) were recorded Significantly higher with application of (FYM 5 t/ha + 7.5 % K sap) which were found to be statistically at par with treatment 8 (8.89). whereas significantly higher test weight (34.17g) with application of (FYM 5 t/ha and 7.5 % K sap) were statistically at par with all treatment. Foliar application of seaweed saps had significantly influenced on the growth and yield of greengram such as number of pods per plant, , number of seeds per pod, test weight . Results reveals that maximum plant growth and yield attributes were obtained in treatment 9 (Zodape *et al.* 2010 , Patel *et al.* 2013 and Choudhary *et al*. 2017).

Grain yield

The statistical data in Table 2 showed that significantly highest grain yield (1633.5 kg/ha) was recorded in treatment 9 (FYM 5 t/ha + 7.5 % K sap), which was statistically at par with treatments (8) FYM 5 t/ha + Panchagavya 5 % (1483.10 kg/ha, respectively). This might be due to presence of growth promoting hormone in seaweed extract attributed to the activation of cell division and cell elongation in the axillary buds which promote and increased number of pods ,seeds and grain yield. These results are in close vicinity with the findings of (Patel *et al*. 2008 and Akhila *et al.* 2017). Interaction effect of organic manures and bioenhancers on dry weight of plant was found to be significant for greengram (Zodape *et al*. 2010, Akhila *et al.* 2017 and pramanick *et al.* 2013).

Stover yield

The data in Table 2 showed that a significantly maximum stover yield (9.82 kg/ha) was recorded with the application (FYM 5 t/ha + 7.5 % K sap) whereas all treatments respectively found to be statistically at par with the highest. The application of FYM and Seaweed K sap. resulted in significantly higher stover yield; this might be due to improved growth in terms of seedling emergence, plant height, and dry matter accumulation, which raises photosynthetic efficiency. Greater photosynthetic accumulation in vegetative components leads to superior vegetative development and hence the stover yield increases. Similar results reported by Patel *et al*. 2008, Akhila *et al.* 2017, Chaudhary *et al.* 2008.

Harvest index

Data presented in table 2 showed that the highest harvest index (34.39 %) was recorded with the application of FYM 5 t/ha + 7.5 % K sap which was statistically at par to all treatment.

Economics

The data on the economics of different treatments presented in Table 3 showed that the maximum gross return (₹1,55,285.42/ha), net return (₹1,00,686.42/ha) and benefit-cost ratio (1.84) was recorded with application of FYM 5 t/ha + 7.5 % K sap and the minimum gross return (₹98,048.86/ha) and net return (₹53,713.86/ha) was observed and lowest benefit-cost ratio (1.21) was recorded in treatment 1 (Vermicompost 2.5 t/ha + Fish amino acid 3 %) . these results might be due to an increase in grain and stover yields in the same treatment as a result of enhanced availability of nutrients by the FYM and better utilization of micronutrients by seaweed k sap. the result were in significantly higher. According to (Yadkar *et al.* 2004 and Yadev *et al*.2014).

Conclusion

On the basis of one season experimentation, it can be concluded that with the application of (FYM 5 t/ha and 7.5 % K sap)Treatment 9 in Greengram has recorded highest test weight, grain yield, stover yield, net return and benefit cost ratio.

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Table 1. Effect of organic nutrient on growth attributes of Greengram.

S. No.	Treatments	Plant height	Dry weight (g)	No of Nodules	CGR (g/g/day)	RGR (g/g/day)
		60 DAS	60 DAS	45 DAS	30-45 DAS	30-45 DAS
1	Vermicompost 2.5 t/ha + Fish amino acid 3 %	32.14	12.65	15.96	16.489	0.1231
2	Vermicompost 2.5 t/ha + Panchagavya 5 %	32.92	13.52	16.99	16.604	0.1161
3	Vermicompost 2.5 t/ha + 7.5 % K sap	33.40	14.11	17.19	16.427	0.1107
4	Goat manure 1 t/ha + Fish amino acid 3 %	33.89	15.17	17.34	16.578	0.1094
5	Goat manure 1 t/ha + Panchagavya 5 %	35.49	16.02	18.40	17.209	0.1073
6	Goat manure 1 t/ha + 7.5 % K sap	37.02	16.49	19.19	17.200	0.1019
7	FYM 5 t/ha + Fish amino acid 3 %	37.79	17.13	20.45	18.960	0.1068
8	FYM 5 t/ha + Panchagavya 5 %	39.79	18.12	21.09	19.689	0.1047
9	FYM 5 t/ha + 7.5 % K sap	42.09	19.35	22.22	20.124	0.1008
SEm(±)		1.30	0.67	0.95	1.29	0.0081
CD (P= 0.05)		3.87	2.02	2.86	3.88	-

Table 2. Effect of organic nutrient on yield attributes and yield of Greengram

S. No.	Treatments	No. of Pods/plant	No. of Seeds/pod	Test weight (g)	Grain yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
1	Vermicompost 2.5 t/ha + Fish amino acid 3 %	8.63	7.35	34.6	1025.3	2076.6	33.05
2	Vermicompost 2.5 t/ha + Panchagavya 5 %	8.80	7.65	34.8	1072.8	2155.8	33.14
3	Vermicompost 2.5 t/ha + 7.5 % K sap	9.27	7.91	35.3	1138.8	2239.7	34.11
4	Goat manure 1 t/ha + Fish amino acid 3 %	9.94	8.16	35.5	1155.8	2357.3	33.88
5	Goat manure 1 t/ha + Panchagavya 5 %	10.08	8.38	36.4	1232.4	2477.6	33.27
6	Goat manure 1 t/ha + 7.5 % K sap	10.44	8.55	36.7	1311.4	2628.8	33.38
7	FYM 5 t/ha + Fish amino acid 3 %	10.78	8.72	37.9	1425.1	2862.9	33.20
8	FYM 5 t/ha + Panchagavya 5 %	10.96	8.89	38.0	1483.1	3010.4	33.00
9	FYM 5 t/ha + 7.5 % K sap	11.05	9.68	38.1	1633.5	3123.5	34.39
SEm(±)		0.48	0.33	1.14	63.23	103.33	1.50
CD (P= 0.05)		1.45	1.06	-	189.57	310.19	-

Table 3. Economics of Greengram as influenced by soil and foliar applied organic nutrients.

S. No.	Treatments	Cost of cultivation (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	Benefit-cost ratio (B:C)
1	Vermicompost 2.5 t/ha + Fish amino acid 3 %	44,335	98,048.86	53,713.86	1.21
2	Vermicompost 2.5 t/ha + Panchagavya 5 %	44025	1,02,504.45	58479.45	1.32
3	Vermicompost 2.5 t/ha + 7.5 % K sap	49,600	1,08,573.14	58973.14	1.18
4	Goat manure 1 t/ha + Fish amino acid 3 %	41,835	1,10,614.49	68,779.49	1.64
5	Goat manure 1 t/ha + Panchagavya 5 %	41,525	1,17,760.81	76,235.81	1.83
6	Goat manure 1 t/ha + 7.5 % K sap	47,100	1,25,995.63	78,895.63	1.67
7	FYM 5 t/ha + Fish amino acid 3 %	49,335	1,36,165.93	86,830.93	1.76
8	FYM 5 t/ha + Panchagavya 5 %	49,025	1,38,152.78	89,127.78	1.81
9	FYM 5 t/ha + 7.5 % K sap	54,600	1,55,285.42	1,00,685.42	1.84

Note: Price of grain yield - ₹8550/q (MSP) and price of stover yield - ₹500/q

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