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Evaluating the efficacy of organic nutrient sources on growth and yield of green gram (*Vigna radiata* L.)

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Abstract
The field experiment was conducted during *Zaid*, season 2024 to study the "Evaluating the efficacy of Organic nutrient sources on growth and yield of Greengram (*Vigna radiata* L.)' at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P. The experiment was laid out in Randomized Block Design with ten treatments which are replicated thrice. The treatment consisted of different levels of solid manures Ghanajeevamruth (500kg/ha), Neem cake (400kg/ha), Mustard Cake (500kg/ha) and liquid organic manure Shasyagavya (5%, 10%, and 15%). The experimental field soil was sandy loam in texture, moderately basic in reaction (pH 7.3), available medium organic Carbon (0.764 %) low in available nitrogen (272.4 kg/ha), and very high accessible phosphorus (34.4kg/ha) and available potassium (252.6 kg/ha). The result showed that significantly higher growth parameters viz., plant height (39.57cm), number of nodules (7.47/plant),number of branches(11.53/plant),dry weight (8.30g/plant) and yield attributes such as effective pod/plant (8.47), seed/pod (10.47), test weight (39.00 g), seed yield (1170.02kg/ha) and stover yield (2216.03kg/ha) were observed with application Mustard Cake 500kg/ha and foliar spray of Shasyagavya 5% in treatment number 7. Highest gross return (Rs.97726.40/ha), net return (Rs.72576.40/ha) and benefit cost ratio (2.89) was also recorded in the same treatment.

Keywords: Economics, ghanajeevamruth, greengram, neem cake, mustard cake and yield

Introduction
Greengram (*Vigna radiata* L.) is a short- duration pulse crop valued for its high protein content, nitrogen-fixing ability, and role in sustainable crop rotations. In recent years, excessive reliance on chemical fertilizers has led to soil degradation, nutrient imbalance, declining productivity, and environmental concerns. Organic farming, which emphasizes the use of locally available, renewable, and eco-friendly nutrient sources, offers a viable alternative for sustaining soil fertility and crop productivity**.** According to IFOAM (International Federation of Organic Agriculture Movements) Organic Agriculture is a whole system approach based upon a set of process resulting in a sustainable ecosystem, safe food, good nutrition, animal welfare and social justice." This stresses the system-wide sustainability and ecological balance. Greengram (*Vigna radiata* L.) is originated in the Indo-Burma region and the area of East Asia. Greengram is considered to be the most hardiest of all pulse crops, belongs to family Leguminosae. It is India's third most important pulse crop in area cultivated and production after chickpea and pigeon pea (Singh *et al*., 2017) [9]. Greengram has many local names, "mung bean, mash or golden gram". It is a short duration pulse crop containing 25 percent protein of high digestibility and has an appreciable amount of 0.621 mg thiamine, 0.233 mg riboflavin (Lokhande *et al.* 2018). The mature seeds contain about 20.97-31.32% protein content (Anwar *et al*.2007), 1-3% fat, 50.4%
carbohydrates, 3.5- 4.5% fibers and 4.5-5.5% ash, while calcium and phosphorus are132 and 367 mg per 100 grams of seed, respectively (Frauque *et al*.2000). A diet combining Greengram seeds contains 6.74 mg iron, 189 mg magnesium and 124 mg potassium and vitamins like 4.8 mg ascorbic, being a legume, it has the capacity to fix the atmospheric nitrogen (30-50 kg). It also helps in pre- venting soil erosion. It is also used as a green manuring crop. When grown in the summer still, the productivity of summer mung bean is low due to significant constraints of nutrient availability (Singh *et al*., 2018) [13]. Uttar Pradesh contributes approximately 3% to India's total green gram production. In the year of

2024-25 the estimated production of greengram in Uttar Pradesh is 0.23 lakh tonnes and the productivity is 500kg/ha (AMIC, 2025).

Ghanajeevamrutha is dry or solid form of Jeevamrutha. Nutrient composition in Ghanajeevamrutha is 1.96% N, 0.17% P, 0.28%K (Devakumar *et al.*, 2014) [2]. Ghanajeevamrutha is as effective asjeevamrutha to the soil. Microbes are the main constituent for increasing soil fertility. For preparation of Ghanajeevamrutha, mix 10 kg of desi cow dung with 2 kg of organic jaggery and 2 kg of pulse flour spread uniformly on the ground to form a layer and 5 liters of desi cow urine on the layer, mix thoroughly. Make a heap of the treated cow dung and cover it again using jute bag for 48 hours. Allow it for fermentation. Then spread on the floor, after shade drying is completed, store it in jute bags in the room. Ghanajeevamrutha is stored for six months and it will be applied before sowing in powder form. Mustard cake obtained after oil extraction from mustard seeds. It is a valuable organic material widely used in agriculture and animal husbandry. Rich in protein, fiber, and residual oil, mustard cake serves as both a natural fertilizer and a supplementary feed for livestock. It has 5.2%N, 1.8%P, 1.2%K (Mukherjee 2010) [16]. In organic farming, it is commonly used as a soil amendment to improve fertility, enhance microbial activity, and suppress soil-borne pathogens due to its bioactive compounds like glucosinolates (Tripathi *et al*.2011) [11]. As a feed ingredient, its high protein content makes it suitable for cattle and poultry, although detoxification may be necessary to reduce anti- nutritional factors. With increasing concerns over the environmental impacts of chemical fertilizers and synthetic feeds, mustard cake has gained attention as a sustainable alternative that supports both soil health and animal nutrition. Its application aligns with eco- friendly agricultural practices and integrated nutrient management systems (Meena *et al*.2017) [9]. Neem cake is an organic manure that enhances soil health and plant growth without harming the environment. Farmers can use neem cake alone or in combination with other organic manures to maximize its benefits. Neem cake contains essential nutrients like nitrogen, phosphorus, potassium, calcium, magnesium, and micro-nutrients such as zinc, copper, iron, and manganese (Gupta, 2022) [6]. Rich in nutrients such as nitrogen 5.2%, phosphorus 1%, and potassium 1.4%, neem cake serves as an effective organic fertilizer and soil conditioner (Gajalakshmi *et al*.2011) [5].

Shasyagavya is a traditional liquid organic manure used in organic farming to enhance soil fertility and crop productivity. It is prepared by fermented mixture of cow dung, cow urine, vegetables waste, and water in 1:1:1:2 ratios, respectively. The nutrient composition of Shasyagavya is 0.086%N, 0.013%P and 0.118%K. It is generally prepared by chopping and fermenting weeds in water along with cow dung. The product is mixed thoroughly by continuous stirring, strained, and used for soil drenching or as a foliar spray. After 9-10 days of fermentation, the solution is ready for use in field (Nene 1999) [8].

Materials and Methods

The experiment was carried out during *Rabi* season of 2024 at crop research farm of Allahabad school of agriculture, Sam Higginbottom University of agriculture, technology and sciences, Prayagraj, which is located at 25^0 24' 42" n latitude, 81^0 50' 56" e longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the river Yamuna by the side of Prayagraj Rewa road about 5 km away from Prayagraj city. The experiment was conducted in randomized block design with 10 treatment each replicated thrice. The plot size of each treatment was 3m x 3m. The factors are Ghanajeevamruth (500kg /ha), Neem cake (400kg/ha), Mustard cake (500kg /ha) and. Shasyagavya (5%, 10%, 15%). The treatment combinations are 1, Ghanajeevamruth (500 kg/ha) +Shasaygavya 5% 2, Ghanajeevamruth (500 kg/ha) + Shasaygavya 10%, 3, Ghanajeevamruth (500 kg/ha) + Shasaygavya 15%, 4., Neem cake (400 kg/ha) + Shasaygavya 5%, 5, Neem cake (400 kg/ha) + Shasaygavya 10%,6., Neem cake (400 kg/ha) + Shasaygavya 15%, 7., Mustard cake (500 kg/ha) + Shasaygavya 5%, 8., Mustard cake (500 kg/ha) + Shasaygavya 10%, 9., Mustard cake (500 kg/ha) + Shasaygavya 15%, 10., Control (FYM + No Foliar Spray). Greengram variety (Virat (IPM 205 -7)) was selected for sowing. Seeds were sown in line manually. Seeds were covered with soil immediately after sowing. The Greengram crop was sown on 16 April 2024. Harvesting was done by taking $1m^2$ area from each. And from it five plants were randomly selected for recording growth and yield parameters. The observations were recorded for plant height, Number of nodules / plants dry weight, Number of branches / plants, crop growth rate, relative growth rate, Number of pods/Plant, Number of seeds/pods, Test weight (g), Seed yield (kg/ha), Stover yield (kg/ha), Harvest index (%). The data was subjected to statistical analysis by analysis of variance method. Economics was calculated viz., cost of cultivation, gross return, net return, benefit cost ratio were calculated.

Result and Discussion

Plant Height (cm): Plant height of green gram was observed from 15 DAS to 60 DAS and highest plant height was observed at 60 DAS. The data reveals that there is no significant difference among the treatments on Plant height**.** Highest plant height (40.45) was observed with the application of Neem cake400kg/ha + Shasyagavya 10% in T_5 which was found be statistically non-significant.

Highest plant height was observed in the application Neem cake might be due to availability of major nutrients to plant as it might has enhanced early root growth and cell multiplication leading to more absorption of other nutrients from soil deeper layers ultimately resulting in increased the plant heigjht (Beniwal and Tomer 2019) [15]. The maximum plant height was observed in the application of Shasyagavya 10% is might be due to it supplies readily available nutrients, natural phytohormones, and beneficial microbes, improves soil-root interactions, and facilitates rapid foliar nutrient uptake, all of which enhance cell division, cell elongation, and internodal growth in the vegetative phase. (Ali, M., *et al* 2012) [12]

Plant dry weight (g/plant): Plant dry weight of green gram was observed from 15 DAS to

60 DAS and highest plant dry weight was observed at 60 DAS. The data reveals that there was a significant difference plant dry weight was observed among the treatments. Significantly highest plant dry weight (9.67 g) was recorded with the application of (Ghanajeevamruth 500kg/ha +

Shasyagavya 10%) in T_2 However, T_1 and T_3 were found to be statistically at par with T_2.
Highest plant dry weight (g) was significantly influenced by application of Ghanajeevamruth might be due to adequate supply and availability of nitrogen and phosphorus in Ghanajeevamruth and FYM to increased dry weight of the plant and better photosynthetic activity due to greater exposure to light and increased the availability of nutrients to the plants which resulted in highest plant dry weight by Singh *et al.,* (2017) [9]. Highest plant dry weight (g) was significantly influenced by application of Ghanajeevamruth might be due to adequate supply and availability of nitrogen and phosphorus in Ghanajeevamruth and FYM to increased dry weight of the plant and better photosynthetic activity due to greater exposure to light and increased the availability of nutrients to the plants which resulted in highest plant dry weight by Singh *et al.,* (2017) [9].

Number of Root nodules/plant: Number of Root nodules/plant of green gram was observed from 15 DAS to 60 DAS and highest Number of Root nodules/plant was observed at
45 DAS. The data reveals that there is no significant difference among the treatments on Number of Root nodules/plant. Highest root nodules (28.13) was observed with the application of Ghanajeevamruth (500kg/ha) + Shasyagavya 10% in T_2 which was found be statistically non- significant.
The highest root nodules was observed in the application of Ghanajeevamruth 500kg/ha might be due to it enhances the Rhizobial population in the rhizosphere, improved soil organic carbon microbial food supply and it regulates microbial signaling and root hair stimulation. It avoiding excess soil nitrogen from chemical fertilizers ultimately resulted the root nodules more (Kumar and Singh 2018) [13].The highest plant root nodules was observed in the foliar spary of shasyagavya 10% is might be due to it supplies a rich population of beneficial for micro-organisims, natural growth-promoting substances (auxins, cytokinins), and organic nutrients that stimulate Rhizobium activity in the rhizosphere. The organic carbon and micronutrients in shasyagavya improve soil microbial biomass, encourage root proliferation and facilitate effective infection thread formation, resulting in greater nodule initiation and development without the suppressive effect of excess mineral nitrogen (Ali *et al*, 2012) [12].

Number of branches/plant: Number of branches/plant of green gram was observed from 15 DAS to 60 DAS and highest Number of Root nodules/plant was observed at 60 DAS. The data reveals that there was significant difference among different treatments. Significant highest number of branches was observed with the application of (Neem cake 400kg/ha + Shasyagavya 10%) in T_5 (11.53), with the application of (Neem cake 400kg/ha +Shasyagavya 15%) in T_6 (11.53) and with the application of (Mustard cake 500kg/ha + Shasyagavya 5%) in T_7 (11.53) which was found significant and at par with rest of treatment except T_10.
Significant and Maximum number of branches per plant was recorded the application of Neem cake might be due to Neem cake contains essential nutrients such as nitrogen, phosphorus, calcium and magnesium these all are vital for vegetative growth and development of a plant. Neem cake increases structural and functional property of soil and foliar application of Shasyagavya recorded the highest number of branches might be due to foliar application promotes branch development as because of nutrient absorption directly through leaf surfaces, improved photosynthetic activity and efficiency and play a crucial role in promoting lateral bud growth and branching.

Yield attributes and Yield
Number of pods/plants: The data reveals that there is no significant difference among the treatments on Number of pods nodules/plant. Highest pods nodules (8.47) was observed with the application of Mustard cake (500kg/ha) + Shasyagavya 5% in T_7 which was found be statistically non-significant.

Number of Seeds/pods: Significant and highest number of seeds/pod (10.47) with the application of mustard cake 500kg/ha + Shasyagavya 5% T_7. However T_2, T_3, T_4, T_5 and T_6 was found to be statistically at par with T_7. The significant maximum number of seeds/pods with application of Mustard cake might be due to it enhanced the availability of essential nutrients such as nitrogen, phosphorous and sulfur from the decomposition of mustard cake. These nutrient promotes the vigorous growth of greengram and it help to increase the pod formation along with promote reproductive phases by Sharma *et al*. (2019) [17]. The application of Shasyagavya recorded maximum number of seeds per pods might be due to improved plant nutrition and hormonal balance by Patil and Gaikwad (2018) [18].

Test Weight (g): Non - significantly highest test weight (39.00) was recorded in T_7 with the application Mustard cake 500kg/ha + Shasyagavya 5%.

Seed yield (kg/ha): Highest seed yield was recorded T_7 with the application of Mustard cake 500kg/ha + Shasyagavya 5% (1170.02kg/ha). However, T_1, T_2, T_3 and T_6 were statistically at par with T_7.
The maximum number of seed yield with the application of mustard cake is due to Mustard cake contribute the soil structure and increased microbial activity and enhanced the nutrient availability may be these factors collectively support better plant growth and higher seed yields in Greengram crop Veena *et al*. (2017) [19]. Further application of Shasyagavya recorded maximum number of seed yield might be due to its rich nutrient profile both macro and micro nutrients and beneficial microbial content contributes to improved seed yield and productivity. It has contain growth promoting substances like auxins and gibberellins, which stimulate plant growth, it reduces the pest and disease incidence these all attributes may be lead to maximum number of seed yield.

Stover Yield (kg/ha): Highest stover yield (2216.30 kg/ha) was recorded in T_6 which was found statistically non-significant among all the treatments.

Harvest index (%): Highest harvest index (37.76%) was recorded in T_1There was no significant difference among the treatments.

Economic analysis: Highest benefit cost ratio (2.89) was found in T_7 as compared to other treatments.

Table 1: Effect of Organic nutrient sources application on yield attributes of Greengram (*Vigna radiata* L.).

S. No	Treatment combination	No of pods/plant	No of seeds/pod	Test weight (g/m)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
1.	Ghanajeevamruth (500kg/ha) + Shasyagavya 5%	8.27	9.83	37.67	1025.10	1690.74	37.76
2.	Ghanajeevamruth (500kg/ha) + Shasyagavya 10%	8.17	10.33	37.33	1044.79	2143.70	32.83
3.	Ghanajeevamruth (500kg/ha) + Shasyagavya 15%	8.37	10.17	36.00	1032.80	1744.44	37.34
4.	Neem cake (400kg/ha) + Shasyagavya 5%	8.20	10.33	35.00	988.57	1928.89	34.38
5.	Neem cake (400kg/ha) + Shasyagavya 10%	7.90	10.03	36.67	915.16	2054.44	30.95
6.	Neem cake (400kg/ha) + Shasyagavya 15%	8.17	10.17	38.00	1090.20	2216.30	33.04
7.	Mustard cake (500kg/ha) + Shasyagavya 5%	8.47	10.47	39.00	1170.02	2062.22	36.25
8.	Mustard cake (500kg/ha) + Shasyagavya 10%	8.23	9.57	37.33	980.95	2007.78	32.80
9.	Mustard cake (500kg/ha) + Shasyagavya 15%	8.10	9.67	38.67	1009.10	2145.93	32.03
10	Control (No foliar spray)	7.90	9.13	36.00	864.53	1595.19	35.22
	S. Em (±)	0.26	0.14	0.91	49.08	138.76	2.06
	CD (p = 0.05)	-	0.44	-	145.84	-	-

Table 2: Effect of Organic nutrient sources application on growth attributes of Greengram (*Vigna radiata* L.).

Treatment Combinations	Plant height (cm)	Plant Dry Weight (g)	Number of Root Nodules/plant	Number of branches per plant
1. Ghanajeevamruth (500kg/ha) + Shasyagavya 5%	40.28	9.60	7.27	11.47
2. Ghanajeevamruth (500kg/ha) + Shasyagavya 10%	35.75	9.67	7.07	11.00
3. Ghanajeevamruth (500kg/ha) + Shasyagavya 15%	39.24	9.30	7.87	11.27
4. Neem cake (400kg/ha) + Shasyagavya 5%	37.55	8.14	7.33	10.93
5. Neem cake (400kg/ha) + Shasyagavya 10%	40.45	7.89	7.53	11.53
6. Neem cake (400kg/ha) + Shasyagavya 15%	38.30	8.77	7.27	11.53
7. Mustard cake (500kg/ha) + Shasyagavya 5%	39.57	8.30	7.47	11.53
8. Mustard cake (500kg/ha) + Shasyagavya 10%	33.78	8.61	7.40	11.27
9. Mustard cake (500kg/ha) + Shasyagavya 15%	37.25	7.99	7.40	11.13
10. Control (FYM+ No foliar spray)	33.30	7.15	7.53	10.33
SEm (±)	2.85	0.23	0.33	0.29
CD (p=0.05)	-	0.71	-	0.89

Table 3: Effect of Organic nutrient sources application on economic of production of Greengram (*Vigna radiata* L.).

S. No	Treatment combination	Cost of Cultivation (INR/ha)	Gross return (INR/ha)	Net Return (INR/ha)	B:C ratio
1.	Ghanajeevamruth (500kg/ha) + Shasyagavya 5%	30150.00	85389.66	55239.66	1.83
2.	Ghanajeevamruth (500kg/ha) + Shasyagavya 10%	30900.00	87870.34	56970.34	1.84
3.	Ghanajeevamruth (500kg/ha) + Shasyagavya 15%	31650.00	86112.89	54462.89	1.72
4.	Neem cake (400kg/ha) + Shasyagavya 5%	23650.00	82943.11	59293.11	2.51
5.	Neem cake (400kg/ha) + Shasyagavya 10%	24400.00	77322.04	52922.04	2.17
6.	Neem cake (400kg/ha) + Shasyagavya 15%	25150.00	91648.59	66498.59	2.64
7.	Mustard cake (500kg/ha) + Shasyagavya 5%	25150.00	97726.40	72576.40	2.89
8.	Mustard cake (500kg/ha) + Shasyagavya 10%	25900.00	82491.56	56591.56	2.19
9.	Mustard cake (500kg/ha) + Shasyagavya 15%	26650.00	85020.12	58370.12	2.19
10	Control (No foliar spray)	29400.00	72352.95	42952.95	1.46

Conclusion: It was concluded that application of Mustard cake 500kg/ha and Shasyagavya 5% T_7 in Greengram has recorded highest seed yield, gross return, net return, stover yield and benefit cost ratio as compared to other treatments. Since, the findings based on the research done in one season.

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