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Effect of Ghanajeevamruth and Amirthakaraisal on growth and yield of Greengram (*Vigna radiata* L.)

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Abstract
In India, Greengram (*Vigna radiata* L.), often known as Mungbean, is a significant pulse crop that is primarily planted during the *Zaid* and *Kharif* seasons. It is a member of the *Fabaceae* family. Organic farming is regarded as one of the finest ways to lessen the excessive use of chemical fertilizers that pollute the environment. During *Zaid* season 2024, a field experiment was carried out at SHUATS Model Organic Farm, Department of Agronomy, SHUATS, Prayagraj (U.P.) "to study the effects of Ghanajeevamruth and Amrithakaraisal on growth and yield of Greengram." Nine treatments were used in the randomized block design experiment, which was duplicated three times. Ghanajeevamruth (100%, 75%, and 50%) and Amirthakaraisal (100%, 75%, and 50%) liquid organic manures were used in varying amounts as part of the treatment. The experimental field soil was sandy loam in texture, moderately basic in reaction (pH 7.1), available medium organic Carbon (0.742 %) low in available nitrogen (245.5 kg/ha), and very high accessible phosphorus (32.3 kg/ha) and available potassium (248.7 kg/ha). The result showed that significantly higher growth parameters viz., plant height (53.37cm), number of nodules (11.27/plant),number of branches(11.60/plant),dry weight (8.45g/plant) and yield attributes such as effective pod/plant (10.23), seed/pod (11.10), test weight (39.00 g), seed yield (1476.44 kg/ha) and stover yield (2273.70kg/ha) were observed with application Ghanajeevamruth 100% and foliar spray of Amirthakaraisal 100%(T1). Highest gross return (Rs.1,122,662.87/ha), net return (Rs.85062.87/ha) and benefit cost ratio (2.26) was also recorded in the same treatment. This concludes that application of Ghanajeevamruth 100% along with foliar spray of Amirthakaraisal 100% performed better in growth and yield of Greengram has recorded highest test weight, grain yield, stover yield, net return and benefit cost ratio and as well as it is economically profitable.

Keywords: Amirthakaraisal, economics, Greengram, Ghanjeevamruth and yield

Introduction
One of the significant legume plants in the *Fabaceae* family of pulses is the Greengram (*Vigna radiata* L.). It is also grown as a green manure crop and is usually referred to as mungbean, mungo, Oregon pea, or just mung. One of India's main Zaid pulse crops, it is planted as a catch crop between the Zaid and Kharif seasons. Compared to other pulses cultivated worldwide, its seed is more pleasant, nutritious, digestive, and non-flatulent. According to Sehrawat *et al.* (2013) [13], greengram seeds provide an average of 20-24% protein, 62.5% carbs, 1.4% fat, 4.2% fiber, and vitamins and minerals. Because it contains adequate iron and fiber, it is easily digested. Due of its brief growing season, it can be used 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) [14]. Greengrams are grown in practically every state in India, which is the world's largest producer. It is grown on around 5.1 million hectares of land in India, yielding about 2.98 million tons and 583 kg/ha of productivity. With a productivity of 492 kg/ha, Rajasthan leads the states in both area and production, accounting for about 48% of the total area and 40% of the total production. Following Madhya Pradesh, which makes up roughly 13% of the land and 25% of the output, Uttar Pradesh grew Greengram, also known as moong, over an area of about 1.12 lakh hectares, producing roughly 0.66 lakh tons with an average productivity of 590 kg per hectare. with a notably higher productivity of 1,109 kg/ha.

Other significant contributors include Maharashtra, Karnataka, Bihar, and Gujarat. (Directorate of Economics and Statistics, Ministry of Agriculture & Farmers Welfare, 2023-24 and (DA&FW 2024).

Any significant output-boosting changes to the agricultural system must be environmentally friendly and enhance the system's sustainability. The careless application of chemical pesticides and fertilizers harms soil wildlife and plants and creates significant problems. Because of these factors, farmers are being forced more and more to switch to organic farming, which includes a variety of choices such as organic manures, bio stimulants, growth regulators, etc., to improve soil fertility and crop output.

Organic manure is necessary for giving plants the nutrients they need. In addition to improving soil fertility and production, it helps to maintain the carbon-to-nitrogen (CN) ratio of the soil. Organic manure is known as a balanced fertilizer since it provides both macro and micronutrients that are essential for plant growth. In order to maintain soil health, it encourages the growth of advantageous soil microorganisms. Through biological decomposition, organic manure provides trace elements like iron, sulfur, molybdenum, and zinc as well as nutrients like nitrogen, phosphorous, and potassium in forms that plants can absorb. Along with promoting soil flora and fauna, it also enhances the physical and chemical characteristics of soil, such as structure, aeration, permeability, water retention, slow nutrient release, and cation exchange capacity. Excessive reliance on chemical fertilizers without adequate organic recycling has exacerbated multi-nutrient deficiencies in soil-plant systems, degraded soil health, and caused environmental pollution. International Fertilizer Development Centre (IFDC) (2019).

Ghanajeevamruth enhances soil biodiversity and improves nitrogen cycle. As the microbes break down organic matter, vital nutrients like potassium, phosphorus, and nitrogen are released in forms that are easily absorbed by plants. This results in healthier soil, which is essential for green gram growth. Ghanajeevamruth's organic matter improves the texture of the soil, increasing its aeration and water-holding ability. This guarantees that the plants have access to moisture for a longer amount of time, which is especially helpful in regions where green grams are cultivated that are prone to drought. Ghanajeevamruth improves seed development, pod formation, and blooming when applied regularly. Higher yields and higher-quality greengram production are the results of enhanced nutrient availability and disease resistance (Babu S 2011) [24].

In natural farming, amirthakaraisal, an organic liquid manure, is applied to enhance soil health and promote plant development. Fresh cow dung, cow urine, jaggery, fertile soil, and water are combined to make it. To encourage microbial activity, the mixture is let to ferment for a few days. Because it improves nitrogen fixation, encourages healthy root nodulation, and provides vital nutrients like nitrogen, phosphorus, potassium, and trace elements, this organic formulation is especially advantageous for leguminous crops like green grams. Amirthakaraisal application increases soil microbial activity, which improves nutrient availability and boosts plant health in general. It is diluted 1:10 and used either as a foliar spray or by soaking the soil. This natural fertilizer not only reduces dependency on chemical fertilizers but also promotes sustainable farming practices. Using Amirthakaraisal can result in better soil structure, increased yield, and improved crop vitality in green gram cultivation. (Nammalvar, G. 2006, Tamil Nadu Agricultural University 2020) [25, 26].

Materials and Methods

During the Zaid season of 2024, a field experiment was conducted in alluvial soil at the Department of Agronomy's Crop Research Farm, SHUATS, Prayagraj, U.P. Low available nitrogen (249.5 kg/ha), medium potassium (248.7 kg/ha), medium organic carbon (0.742%), a nearly neutral soil response (pH 7.1), 0.462 ds/m electrical conductivity, and extremely high accessible phosphorus (32.3 kg/ha) were all present in the experimental plot's sandy loam soil. Greengram seeds (Virat IPM 205-7) were planted on April 19, 2024, with a 30 cm × 10 cm spacing. Ten treatment combinations, including soil applications of Ghanajeevamruth 100% and Amirthakaraisal 100% at 15 and 30 days, were implemented using a randomized block design and reproduced three times. Using a hand hoe, furrows 4-5 cm deep were dug along the seed rows in order to apply organic manure as a spreading method. Once germination occurred, the gaps were closed by transplanting ten days following sowing. Seedlings were removed where needed to keep the space between plants at 30 cm by 10 cm. Intercultural operations were conducted at intervals of 15 to 30 days in order to decrease crop density and weed competition. The crop was harvested on June 26th, 2024. Plant growth characteristics, including plant height (cm), number of nodules, number of branches, and dry weight (g/plant), were measured at regular intervals from germination until harvest. At harvest, yield attributes such as pods/plant, seeds/pod, test weight (g), seed yield (kg/ha), stover yield (kg/ha), and harvest index (%) were measured at 15, 30, 45 and 60 DAS. Analysis of variance (ANOVA), as it relates to randomized block design, was used to statistically examine the observed data of ten treatments (Gomez and Gomez, 1984) [5].

Results and Discussions

Growth parameter

The data of growth parameter are presented in Table 1. The application of (Ghanajeevamruth 100% and Amirthakaraisal 100%) in treatment 1 resulted in the significantly largest plant height (53.37 cm). On the other hand, treatment 5 (Ghanajeevamruth 75% + Amirthakaraisal 75%) had the highest treatment and the lowest length (44.06 cm). The early growth of seedlings may be caused by the application of Amirthakaraisal 100%, which boosts growth and development capacity and produces growth-promoting hormones like IAA, IBA, cytokinins, gibberellins, trace elements, vitamins, amino acids, antibiotics, and micronutrients (Patel *et al*. 2008 and Yadev *et al*. (2014), Chaudhary *et al*. 2008) [27, 28, 29]. As a result, there are substantially more nodules (11.27) in this treatment than in treatment 1 (Ghanajeevamruth 100% and Amirthakaraisal 100%). Significant increase in nodule number was observed at flowering stage due to foliar spray of Amirthakaraisal 100 % while nodule and dry weight increased significantly due to Amirthakaraisal 100 % at all the concentrations Priyanth *et al*. (2022) [13]. These findings are consistent with those of Kumar *et al*. (2023) [30]. The foliar spray of 100% Amirthakaraisal produced the most nodules and dry weight. The foliar spray of 100% Amirthakaraisal produced the most nodules and dry weight. Thus, in this therapy.

Significantly higher dry weight (9.68 g) was recorded in treatment 1 (Ghanajeevamruth 100% and Amirthakaraisal 100%), which was statistically comparable to treatment 1 (Ghanajeevamruth 100% and Amirthakaraisal 100%), which was statistically comparable to treatments (2,3) Ghanajeevamruth 100% + Amirthakaraisal 75% and Ghanajeevamruth 100% + Amirthakaraisal 50% accordingly. Amirthakaraisal applied topically had a major impact on Greengram's growth and development as well as its increased weight. The application of treatment 1 (Ghanajeevamruth 100% and Amirthakaraisal 100%) resulted in the highest number of branches (11.60%), which may be the result of growth-promoting hormones in Amirthakaraisal that increase the activation of cell division and cell elongation in the axillary buds. These findings closely align with those of Akhila *et al*. (2017) [31] and Patel *et al*. (2008) [27]. For Greengram, the interaction between Ghanajeevamruth and Amirthakaraisal on the plant's dry weight and branch count was found to be significant.

Yield attributes

Table 2 Sowed the result related to yield-attributing characters. The application of treatment 1 (Ghanajeevamruth 100% and Amirthakaraisal 100%) produced the highest number of pods/plant (10.23), which was statistically comparable to treatments 5, 6, 7, and 8. Treatment 1 (Ghanajeevamruth 100% and Amirthakaraisal 100%) was found to have a significantly higher number of seeds/pod (11.10%), while treatment 8 was found to be statistically equivalent to treatment 1 (Ghanajeevamruth 100% and Amirthakaraisal 100%). However, the application of treatment 1 (Ghanajeevamruth 100% and Amirthakaraisal 100%) resulted in a considerably greater test weight (39.0 g) that was statistically equivalent to other treatments. Amirthakaraisal applied topically had a major impact on greengram growth and yield, including test weight, number of seeds per pod, and number of pods per plant. According to Choudhary *et al*. (2017) [4] and Priyanth *et al*. (2022) [13], treatment 1 (Ghanajeevamruth 100% and Amirthakaraisal 100%) produced the highest plant growth and yield attributes.

Grain yield

According to the statistical data in Table 2, treatment 1 (Ghanajeevamruth 100% and Amirthakaraisal 100%) had the significantly highest grain yield (1476.44 kg/ha), which was statistically comparable to treatments (2,3) Ghanajeevamruth 100% + Amirthakaraisal 75% and Ghanajeevamruth 100% + Amirthakaraisal 50%, respectively. The activation of cell division and cell elongation in the axillary buds, which promotes an increased number of pods, seeds, and grain yield, may be the result of growth-promoting hormones present in Amirthakaraisal. These findings closely align with those of Akhila *et al*. (2017) [31] and Patel *et al*. (2008) [27]. For Greengram, the interaction between Ghanajeevamruth and Amirthakaraisal on plant growth and development was determined to be substantial (Kumar *et al*. 2023) [30].

Stover yield

According to the results in Table 2, the application of Ghanajeevamruth 100% and Amirthakaraisal 100% resulted in a substantially higher stover yield (2273.70 kg/ha), while all other treatments were found to be statistically equivalent to the highest. The stover output increased significantly after Ghanajeevamruth and Amirthakaraisal were applied; this could be because of better growth in terms of plant height, seedling emergence, and dry matter build up, all of which increase photosynthetic efficiency. Superior vegetative development results from increased photosynthetic accumulation in vegetative components, which raises stover production. Similar findings were published by Chaudhary *et al*. (2008) [29] and Patel *et al*. (2008) [27].

Harvest index

Data presented in table 2 showed that the highest harvest index (39.40 %) was recorded with the application of Ghanajeevamruth 100 % and Amirthakaraisal 100 % which was statistically at par to all treatments Priyanth *et al.* (2022) [13].

Economics

With the application of Ghanajeevamruth 100% and Amirthakaraisal 100%, treatment 1 demonstrated the highest gross return (₹1,22,662.87/ha), net return (₹85,062.87/ha), and benefit-cost ratio (2.26). Treatment 5 (Ghanajeevamruth 75% + Amirthakaraisal 75%) showed the lowest benefit-cost ratio (1.54), and the minimum gross return (₹93,230.55/ha) and net return (₹56,505.55/ha) was observed. These findings may be the consequence of increased grain and stover yields in the same treatment as a result of improved nutrient availability by Ghanajeevamruth and improved micronutrient use by Amirthakaraisal, which produced noticeably higher results. As stated by Yadev *et al*. (2014) [28] and Priyanth *et al*. (2022) [13].

Table 1: Effect of Ghanajeevamruth and Amirthakaraisal on growth attributes of Greengram.

		Plant height (cm)	Dry weight (g)	No of Nodules	No of Branches	CGR (g/g/day)	RGR (g/g/day)
S. No.	Treatments	60 DAS	60 DAS	45 DAS	60 DAS	30-45 DAS	30-45 DAS
1	Ghanajeevamruth 100 % + Amirthakaraisal 100%	53.37	9.63	24.17	11.60	6.79	0.050
2	Ghanajeevamruth 100 % + Amirthakaraisal 75%	50.18	9.36	20.77	10.93	6.74	0.052
3	Ghanajeevamruth 100 % + Amirthakaraisal 50%	50.20	9.60	22.07	11.60	8.01	0.057
4	Ghanajeevamruth 75 % + Amirthakaraisal 100%	46.84	8.93	20.20	10.40	6.65	0.054
5	Ghanajeevamruth 75 % + Amirthakaraisal 75%	44.06	7.18	21.73	10.93	5.63	0.050
6	Ghanajeevamruth 75 % + Amirthakaraisal 50%	48.02	8.63	21.07	11.20	6.52	0.052
7	Ghanajeevamruth 50 % + Amirthakaraisal 100%	48.73	7.49	20.47	11.40	6.93	0.060
8	Ghanajeevamruth 50 % + Amirthakaraisal 75%	49.86	7.45	18.87	10.87	5.67	0.050
9.	Ghanajeevamruth 50 % + Amirthakaraisal 50 %	50.94	8.17	20.87	10.47	6.50	0.056
10	Control (FYM 10 t/ha)	44.51	6.89	19.73	10.13	5.78	0.058
	Sem (+)	2.55	0.45	0.57	0.27	0.50	0.003
	CD (P= 0.05)	-	1.47	1.72	0.83	-	-

Table 2: Effect of Ghanajeevamruth and Amirthakaraisal on yield attributes and yield of Greengram

S. No.	Treatments	No. of Pods/plant	No. of Seeds/ pod	Test weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)	Net returns (₹/ha)	Benefit-cost ratio (B:C)
1	Ghanajeevamruth 100 % + Amirthakaraisal 100%	10.23	11.10	39.00	1476.44	2273.70	39.41	85062.87	2.26
2	Ghanajeevamruth 100 % + Amirthakaraisal 75%	9.80	10.73	38.67	1353.85	2032.96	39.96	75023.93	2.01
3	Ghanajeevamruth 100 % + Amirthakaraisal 50%	9.83	10.67	38.33	1351.11	1799.26	42.87	74587.32	2.01
4	Ghanajeevamruth 75 % + Amirthakaraisal 100%	8.97	10.70	37.00	1189.69	2082.96	36.19	62366.13	1.69
5	Ghanajeevamruth 75 % + Amirthakaraisal 75%	8.97	10.37	36.50	1116.03	1974.07	36.09	56505.55	1.54
6	Ghanajeevamruth 75 % + Amirthakaraisal 50%	9.10	10.73	38.67	1257.67	1675.19	42.89	67488.97	1.85
7	Ghanajeevamruth 50 % + Amirthakaraisal 100%	9.53	10.63	37.00	1227.33	2550.74	32.63	66938.15	1.84
8	Ghanajeevamruth 50 % + Amirthakaraisal 75%	9.67	10.23	36.67	1206.70	1940.74	38.50	64317.21	1.78
9	Ghanajeevamruth 50 % + Amirthakaraisal 50 %	9.33	9.91	38.00	1216.22	1525.19	44.37	64498.24	1.80
10	Control (FYM 10 t/ha)	8.70	9.84	38.00	1060.21	1572.96	40.29	53862.73	1.58
	SEm (+)	0.22	0.24	0.96	52.64	102.44	1.25		
	CD (P= 0.05)	0.67	0.74	-	156.43	304.44	3.73		

Conclusion

On the basis of one-year experimentation, it concludes that with the application of Ghanajeevamruth 100 % along with Amirthakaraisal 100 % performed better in growth and yield of Greengram has recorded highest test weight, grain yield, Stover yield, net return and benefit cost ratio and as well as economically profitable.

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Competing Interests

Authors have declared that no competing interests exits.

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