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EFFECT OF DIFFERENT ORGANIC NUTRIENT SOURCES ON GROWTH, YIELD AND YIELD ATTRIBUTES OF GREENGRAM (*Vigna radiata* L.)

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ABSTRACT

A field experiment was conducted during the summer season of 2023 at the Organic Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, to evaluate the effect of different organic nutrient sources on soil fertility and productivity of green gram (*Vigna radiata* L.). The experiment comprised twelve treatments consisting of different combinations of recommended dose of nitrogen (RDN) through NADEP compost along with soil and foliar application of liquid organic formulations *viz.*, Tatva-G, Jivamrut and Ghan-jivamrut. The experiment was laid out in a Randomized Block Design with three replications. Results indicated that growth parameters, particularly plant height at 40 DAS, 60 DAS and harvest were significantly improved under integrated application of organic nutrients. The treatment T5 (75% RDN + 500 L ha^{-1} Tatva-G + Tatva-G @10%) recorded the maximum plant height and significantly higher number of pods per plant. Grain yield was significantly highest under treatment T5 (930.57 kg ha^{-1}), which remained statistically at par with treatments T2 (100% RDN + *Tatva*-G @10%) (910.00 kg ha^{-1}) and T6 (75% RDN + 500 l/ha *Tatva*-G + Jivamrut @ 10%) (832.20 kg ha^{-1}). Maximum stover yield was recorded with treatment T6 (2016.26 kg ha^{-1}). Harvest index was not significantly affected by treatments. Overall, integrated application of NADEP compost with Tatva-G and Jivamrut proved effective in enhancing growth and yield of green gram under organic farming conditions.

Keywords **:** Green gram, Organic farming, NADEP compost, Tatva-G, Jivamrut, Grain yield, Soil fertility.

Introduction

In India, pulses are the most frequently consumed protein source, reflecting their vital importance in the daily diet of the population. However, the increasing demand for pulses has exceeded the country's domestic production capacity, making imports necessary (Das *et al.,* 2018). During the last decade, the growth rate of pulse production remained about 32% lower than that of cereals mainly because of farmer's preference cultivating cereal crops over pulses. This preference is largely due to the low yield potential of pulses and their susceptibility to pests and diseases, which limits their wider adoption by farmers (Vilas *et al.,* 2018).

Green gram (*Vigna radiata* L.) also known as mung bean or golden gram, is an important short-duration pulse crop widely cultivated in India during the *kharif* season. It is a self-pollinated legume with chromosome number 2n = 22 and is grown as a sole crop, intercrop, or catch crop under diverse cropping systems. Green gram is nutritionally rich, containing about 23–25%protein, along with carbohydrates, minerals and vitamins, and is considered an economical source of dietary protein. Being a leguminous crop, green gram has comparatively low nitrogen requirement as it fulfils a major portion of its nitrogen demand through symbiotic nitrogen fixation by root nodule bacteria, which enhances soil fertility and contributes to sustainable agriculture (Kannaiyan, 1999). In India, green gram occupies 64.56 lakh ha and produces 4.05 million tonnes (Anon., 2022), contributing nearly 8% of the total pulse area and ranking second among pulse crops in both area and production. Therefore, to achieve higher productivity along with improved soil health, the adoption of organic nutrient management practices is essential for sustainable green gram cultivation.

Organic fertilizers play an important role in improving soil health, nutrient availability and crop productivity, yet their adoption remains limited among farmers. Continuous and indiscriminate use of synthetic chemical fertilizers has resulted in deterioration of soil health, reduced nutrient use efficiency, and declining sustainability of production systems. Prolonged dependence on chemical fertilizers adversely affects soil physical, chemical and biological properties, leading to reduced fertilizer use efficiency and long-term productivity (Almaz *et al.,* 2017). Therefore, adoption of organic nutrient management practices is essential to enhance green gram productivity while maintaining soil fertility and sustainability. In recent years, organic formulations like Panchagavya, Jivamrut *etc*., have been used to supply essential nutrients, growth-promoting substances and beneficial microorganisms, which improve soil health, nutrient uptake and crop productivity (Kumar *et al.,* 2022; Patel *et al.,* 2026; Solanki *et al.,* 2020). Organic fertilizers promote nutrient cycling through microbial decomposition of organic matter, thereby increasing nutrient availability in soil (Wallenstein *et al.,* 2017; Patel *et al.,* 2023). Soil fertility restoration requires sustaining soil microbial biomass through organic inputs, reduced tillage and minimal use of synthetic chemicals (Kumaravelu *et al.,* 2009). Therefore, an experiment was conducted to study the effect of different organic nutrient sources on growth, yield and yield attributes of greengram (*Vigna radiata* L.)

Materials and Methods

A field experiment was conducted during the summer season of 2023 at the Organic Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, the soil of experimental field was low in available nitrogen (231.27 kg/ha) and medium in available phosphorus (36.14 kg/ha) as well as high in available potassium (574.13 kg/ha). The organic carbon content was medium (0.65 %). The pH (7.80) of soil was slightly alkaline and salinity (0.32 dS/m) was ideal. For the experiment, it was laid out in a Randomized Block Design (RBD) with 12 treatments comprising T_1: 100% RDN through NADEP compost (Control), T_2 :100% RDN + *Tatva*-G @10%, T_3 :100% RDN + Jivamrut @10%, T_4 :75% RDN + 500 l/ha *Tatva*-G, T_5 :75% RDN + 500 l/ha *Tatva*-G + *Tatva*-G @10%, T_6 :75% RDN + 500 l/ha *Tatva*-G + Jivamrut @ 10%, T_7 :50% RDN +500 l/ha *Tatva*-G, T_8 :50% RDN + 500 l/ha *Tatva*-G + *Tatva*-G @10%, T_9 : 50% RDN + 500 l/ha *Tatva*-G + Jivamrut@10%, T_{10} :500 kg/ha Ghan-Jivamrut + 500 l/ha Jivamrut, T_{11} :500 kg/ha Ghan-Jivamrut + 500 l/ha Jivamrut +*Tatva*-G @10% and T_{12} :500 kg/ha Ghan-Jivamrut + 500 l/ha Jivamrut + Jivamrut @10% with three replications. Green gram variety GM-6 was sown on 14th March, 2023 at a spacing of 45 cm × 10 cm by maintaining seed rate of 20 kg/ha. The RDN through solid manure was applied as basal in all treatments while liquid formulations were applied through soil application (two times with irrigation water *i.e.,* at the time of sowing and 25 DAS) and foliar spray (two sprays at 30 and 45 DAS) as per the treatment. Before sowing, seeds were treated with *Rhizobium* culture and PSB biofertilizers each of @ 10 ml/kg. *Tatva*-G was prepared with taking fresh 1 kg Papaya leaves + 1 kg Glyricidia leaves + 2 litre cow urine and make up a volume of 10 litre by adding water further incubate for 45 days. Before that Glyricidia based different formulations were preparing with different plant leaves and among them best combination with papaya was identify which naming as *Tatva*-G. Prior to this, various formulations based on Gliricidia sepium were prepared, incorporating extracts from different plant leaves. Among these, the combination containing papaya leaf was identified as the most effective, which was subsequently named Tatva-G. Standard agronomic practices such as gap filling, thinning, weeding, irrigation *etc* were followed during the growth of the stage. Plant protection with neem-based biopesticides was followed. Growth and yield parameters, including plant height, branches per plant, pods per plant, seeds per pod, test weight, grain and stover yield, were recorded from randomly selected plants.

Results and Discussion

Growth Attributes

Data pertaining to plant height and the number of branches per plant are presented in Table 1. Plant height increased progressively with crop growth stage advancement, and significant differences were observed at later stages. At 20 DAS, plant height did not vary significantly among treatments, indicating negligible treatment effect during early vegetative growth. However, onward from 40 DAS, plant height differed significantly, showing the influence of organic nutrient sources on crop vigour. At 40 and 60 DAS, the maximum plant height was recorded with treatment T5 (75% RDN + 500 L ha^{-1} Tatva-G + Tatva-G @10%)

(26.08 cm and 46.44 cm) which remained statistically at par with treatments T2 (25.63 cm and 44.65 cm), T6 (25.39 cm and 44.46 cm), T3 (24.73 cm and 43.63 cm) and T8 (24.62 cm and 43.37 cm). Minimum plant height was recorded with treatment T10 (500 kg ha^{-1} Ghan-jivamrut + 500 L ha^{-1} Jivamrut) (21.00 cm and 30 cm). At harvest, treatment T5 recorded maximum plant height (49.23 cm). The number of branches per plant recorded at harvest was ranged from 4.00 to 5.10 branches $plant^{-1}$. Numerically, the highest number of branches was recorded under treatment T5 (75% RDN + 500 L ha^{-1} Tatva-G + Tatva-G @10%) (5.10) followed by treatment T3 (100% RDN + Jivamrut @10%) (5.03) and T2 (100% RDN + Tatva-G @10%) (5.02). Among the treatments, lowest number of branches was recorded under treatment T9 (50% RDN + 500 L ha^{-1} Tatva-G + Jivamrut @10%) (4.00). The improvement in plant height and number of branches per plant under integrated treatments suggests enhanced nutrient availability, microbial activity and better nutrient uptake efficiency due to combined soil and foliar organic applications. The increased growth parameters due to enhanced nutrient availability and the production of growth-promoting substances that might have caused cell elongation and leaf multiplication observed in green gram following foliar spray of liquid fertilizer by Akhila *et al.*, 2017. Higher branching under integrated organic nutrient treatments indicates a positive response of green gram towards balanced nutrient supply and growth-promoting substances present in liquid organic formulations. Tatva-G stimulates microbial activity in soil, accelerating nutrient mineralization and improving nutrient uptake efficiency, thereby promoting better vegetative growth. Jivamrut is considered an effective organic growth promoter that enhances crop biological efficiency by improving soil health, providing protection against diseases, and increasing the nutritional quality of fruits and vegetables (Devakumar *et al.*, 2014). It contains a diverse population of beneficial microorganisms such as bacteria, actinomycetes, and fungi, which enhance the activity of nitrogen-fixing and phosphorus-solubilizing microbes, thereby supporting better plant growth (Reddy et al., 2021). The combined application of solid organic and liquid organic fertilizer significantly improved the growth and yield of different crops like fenugreek by Lunagariya *et al.* (2018), chickpea by Bag *et al.* (2015) and black gram by Patel *et al.* (2024).

Table 1: Effect of organic nutrient treatments on plant height (cm) and number of branches per plant of green gram

Treatments	Plant height (cm)				Branches $plant^{-1}$ at harvest
	20 DAS	40 DAS	60 DAS	At harvest	
100 % RDN through NADEP compost (Control)	8.39	23.54	40.0	42.68	4.92
100 % RDN + Tatva-G @10 %	8.65	25.63	44.65	47.00	5.02
100 % RDN + Jivamrut @10 %	8.23	24.73	43.63	45.13	5.03
75 % RDN + 500 l/ha Tatva-G	8.00	22.50	42.00	44.00	4.68
75 % RDN + 500 l/ha Tatva-G + Tatva-G @10 %	8.67	26.08	46.44	49.23	5.10
75 % RDN + 500 l/ha Tatva-G + Jivamrut @10 %	8.51	25.39	44.46	46.89	5.00
50 % RDN + 500 l/ha Tatva-G	7.85	21.99	40.08	42.87	4.10
50 % RDN + 500 l/ha Tatva-G + Tatva-G @10 %	8.19	24.62	43.37	45.61	4.90
50 % RDN + 500 l/ha Tatva-G + Jivamrut @10 %	7.53	21.40	40.76	42.98	4.00
500 kg/ha Ghan-jivamrut + 500 l/ha Jivamrut	7.69	21.00	39.0	42.00	4.30
500 kg/ha Ghan-jivamrut + 500 l/ha Jivamrut + Tatva-G @10 %	7.88	22.45	41.03	44.04	4.47
500 kg/ha Ghan-jivamrut + 500 l/ha Jivamrut + Jivamrut @10 %	7.26	22.76	41.45	44.33	4.40
SEm ±	0.38	0.86	1.46	1.41	0.29
CD (P=0.05)	NS	2.53	4.28	4.13	NS
CV (%)	8.09	6.34	5.98	5.45	10.77

Yield attributes

Yield attributes are the important factors that directly impact to the yield. Yield attributes were variably influenced by different organic nutrient treatments (Table 2). The number of pods per plant showed significant variation, whereas seeds per pod, pod length and test weight were found non-significant. The maximum number of pods per plant was recorded with treatment T5 (75% RDN + 500 L ha^{-1} Tatva-G + Tatva-G @10%) (26.50), which was statistically at par with treatments T2 (24.68), T6 (24.21), T3 (23.81) and T1 (23.03). Increased pod formation under integrated treatments indicates better nutrient availability and improved reproductive development. The number of seeds per pod was not significantly influenced, but numerically, the maximum seeds per pod were recorded with treatment T5 (75% RDN + 500 L ha^{-1} Tatva-G + Tatva-G @10%) (10.17) followed by T6 (10.00). Treatment T10 (500 kg ha^{-1} Ghan-jivamrut + 500 L ha^{-1} Jivamrut) recorded significantly lowest number of pods per plant (17.73) as well as number of seeds per pod (9.60). The non-significant trend suggests that seeds per pod are relatively stable and less responsive to nutrient management. Pod length remained non-significant across treatments. However, numerically maximum pod length was recorded under T5 (75% RDN + 500 L ha^{-1} Tatva-G + Tatva-G @10%) (9.47 cm) and the minimum was recorded under T12 (500 kg ha^{-1} Ghan-jivamrut + 500 L ha^{-1} Jivamrut + Jivamrut @10%) (8.51 cm)**.** This indicates that integrated treatments may support pod development through improved assimilate supply. Test weight (1000 grain weight) was non-significant among treatments. Numerically, the maximum 1000 grain weight was recorded under T5 (52.67 g), followed by T11 (51.83 g) and T10 (51.67 g). The minimum test weight was recorded under T1 (100% RDN through NADEP compost) (45.33 g). Though non-significant effect, higher test weight under integrated treatments reflects better seed filling due to improved nutrient mobilization. The improvement in yield attributes might be attributed to enhanced uptake of macro- and micronutrients by the plants, along with the presence of growth-promoting substances such as auxins and cytokinins in liquid manures. Similar results were reported by Leindah and Mani (2015), who observed that foliar application of organic substances in green gram increased the number of pods per plant, test weight, and number of seeds per pod. The results are also in agreement with similar line of research work carried out by Patel *et al.* in green gram (2023), Solanki *et al.* in carrot (2020), Lunagariya *et al.* (2018) in fenugreek and Bag *et al.* (2015) in chickpea.

Table 2: Effect of organic nutrient treatments on yield attributes of green gram

Treatments	Pods plant^{-1}	Seeds pod^{-1}	Pod length (cm)	Test weight (g)
100 % RDN through NADEP compost (Control)	23.03	9.67	9.33	45.33
100 % RDN + Tatva-G @10 %	24.68	9.77	9.43	47.67
100 % RDN + Jivamrut @10 %	23.81	9.70	9.29	50.17
75 % RDN + 500 l/ha Tatva-G	22.73	9.90	9.28	46.83
75 % RDN + 500 l/ha Tatva-G + Tatva-G @10 %	26.50	10.17	9.47	52.67
75 % RDN + 500 l/ha Tatva-G + Jivamrut @10 %	24.21	10.0	9.34	49.67
50 % RDN + 500 l/ha Tatva-G	20.51	9.90	8.95	46.67
50 % RDN + 500 l/ha Tatva-G + Tatva-G @10 %	21.90	9.77	8.85	47.67
50 % RDN + 500 l/ha Tatva-G + Jivamrut @10 %	19.60	9.73	9.08	47.33
500 kg/ha Ghan-jivamrut + 500 l/ha Jivamrut	17.73	9.60	8.87	51.67
500 kg/ha Ghan-jivamrut + 500 l/ha Jivamrut + Tatva-G @10 %	17.85	9.63	9.01	51.83
500 kg/ha Ghan-jivamrut + 500 l/ha Jivamrut + Jivamrut @10 %	17.75	9.77	8.51	51.00
SEm ±	1.34	0.60	0.43	2.50
CD (P=0.05)	3.94	NS	NS	NS
CV (%)	10.74	10.64	8.24	8.84

Grain yield, stover yield and harvest index

Grain yield and stover yield were significantly influenced by organic nutrient treatments, whereas harvest index remained non-significant (Table 3). Grain yield was significantly highest with treatment T5 (75% RDN + 500 L ha^{-1} Tatva-G + Tatva-G @10%) (930.57 kg ha^{-1}) which was statistically at par with treatments T2 (910.00 kg ha^{-1}) and T6 (832.20 kg ha^{-1}). The minimum grain yield was recorded with treatment T10 (500 kg ha^{-1} Ghan-jivamrut + 500 L ha^{-1} Jivamrut) (720.65 kg ha^{-1}). Higher yield under integrated treatments was mainly attributed to increased pods per plant and improved crop growth. Soil application of enriched banana pseudostem sap, panchgavya and jivamrut which are rich source of several plant essential nutrients hence soil application of this liquid organics provides balance nutrition to the crop. Growth hormones present in these fermented liquid formulations helps in root development, mineral absorptions, photosynthesis and ultimately increases crop yield. Their easy assimilation of nutrients supplied through fermented liquid formulation was also reported by Akhila *et al.* (2017). Rakha *et al.* (2022) in green gram reported that increase in the yield associated with the release of macro and micro nutrients during the course of microbial decomposition. Organic matter also functions as a source of energy for soil micro flora which brings about transformation of other nutrients held in soil or applied through other means, in a form that it is readily utilized by growing plants which helped in increase of seed yield. Stover yield was significantly higher under treatment T6 (75% RDN + 500 L ha^{-1} Tatva-G + Jivamrut @10%) (2016.26 kg ha^{-1}), followed by T3 (1979.33 kg ha^{-1}) and T5 (1913.33 kg ha^{-1}). The minimum stover yield was recorded with treatment T10 (500 kg ha^{-1} Ghan-jivamrut + 500 L ha^{-1} Jivamrut) (1680.00 kg ha^{-1}). Increase yield of stover yield might be due to cow urine present in Tatva-G which also contains hormonal substances responsible for nitrogen supply, accelerate the process of elongation and cell division enhances crop growth. Higher production of photosynthates and better translocation within plants resulting in better development of plant height ultimately increases stover yield (Gohain and Kikon, 2017). The combined application of organics such as vermicompost, compost and FYM etc and liquid organics viz panchgavya, cow urine, Jivamrut and vermiwash which contain microbes and plant growth promoting substances stimulate growth, yield and quality of crops reported by Yadav *et al.* (2017) in chickpea and Patel *et al.* (2024) in black gram. Higher biomass production under Tatva-G and Jivamrut combinations indicates improved vegetative growth and dry matter accumulation due to enhanced nutrient availability and microbial activity. Harvest index did not differ significantly among treatments. Numerically, the maximum harvest index was recorded under T2 (100% RDN + Tatva-G @10%) (32.83%), followed by T5 (32.70%), while the minimum harvest index was observed under T3 (100% RDN + Jivamrut @10%) (28.85%).

The positive response with the combined application of RDN and *G-amrut,* prepared from glyricidia extract, which has growth promoting substances, was observed due to the better nutrient availability and its favorable effect on soil physical and biological properties, resulting in increased yield attributes (Patel *et al.,* 2026). Applying liquid organic nutrients like Jivamrut, seaweed sap, and enriched banana pseudostem sap (EBPS) to acidic soil raises its pH level, while in alkaline soil, it lowers the pH. This practice leads to sustainable increases in crop yield and eliminates the need for chemical fertilizers, thereby enhancing soil health. Jivamrut exhibits acidity with a pH level of 4.93 and acts as a valuable reservoir of essential macro and micro nutrients (Rai and Jolly, 2024; Akhila *et al.,* 2017). Iron improves photosynthesis and assimilates transportation to sinks and finally increases seed and stover yield. This may include an increase in carbohydrate synthesis (Pramanick *et al.,* 2013). Stover yield and harvest index were maximum under T6 and T2 treatments, respectively. A similar result was found by Yadav *et al.* (2017), Raksha *et al.* (2022) and Iswarya *et al.* (2019).

Table 3 : Effect of organic nutrient treatments on grain yield, stover yield and harvest index of green gram

Treatments	**Grain yield (kg ha^{-1})**	**Stover yield (kg ha^{-1})**	**Harvest index (%)**
100 % RDN through NADEP compost (Control)	806.56	1840.67	30.50
100 % RDN + Tatva-G @10 %	910.00	1861.50	32.83
100 % RDN + Jivamrut @10 %	802.67	1979.33	28.85
75 % RDN + 500 l/ha Tatva-G	800.00	1866.67	30.00
75 % RDN + 500 l/ha Tatva-G + Tatva-G @10 %	930.57	1913.33	32.70
75 % RDN + 500 l/ha Tatva-G + Jivamrut @10 %	832.20	2016.26	29.20
50 % RDN + 500 l/ha Tatva-G	731.91	1788.87	29.00
50 % RDN + 500 l/ha Tatva-G + Tatva-G @10 %	796.67	1753.33	31.20
50 % RDN + 500 l/ha Tatva-G + Jivamrut @10 %	750.80	1808.47	29.30
500 kg/ha Ghan-jivamrut + 500 l/ha Jivamrut	720.65	1680.00	30.00
500 kg/ha Ghan-jivamrut + 500 l/ha Jivamrut + Tatva-G @10 %	751.76	1763.33	29.9
500 kg/ha Ghan-jivamrut + 500 l/ha Jivamrut + Jivamrut @10 %	733.33	1762.02	29.3
SEm ±	41.60	63.98	1.80
CD (P=0.05)	122.02	187.65	NS
CV (%)	9.04	6.04	10.10

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