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Nishika
Department of Agriculture, Vivekananda Global University, Jaipur, Rajasthan, India

Raju Singh Jakhar
Department of Agriculture, Vivekananda Global University, Jaipur, Rajasthan, India

Ravi P Meena
Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India

Utkarsh Rai
Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India

R Suthar
Division of Agronomy, RARI, Durgapura, Jaipur, Rajasthan, India

Corresponding Author:
Nishika
Department of Agriculture, Vivekananda Global University, Jaipur, Rajasthan, India

Impact of Jeevamrut on growth, yield and quality of Green Gram (*Vigna radiata* L.)

Nishika, Raju Singh Jakhar, Ravi P Meena, Utkarsh Rai and R Suthar

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Abstract
A field experiment was carried out during the kharif season of 2025 at the Agronomy Farm, Vivekananda Global University, Jaipur, Rajasthan, to evaluate the effect of different concentrations of Jeevamrut on the growth, yield, and quality of green gram (*Vigna radiata* L.). The variety RMG-492 was sown on 9 July 2025 using a spacing of 30 cm × 10 cm with the recommended seed rate of 12 kg ha^{-1}. Application of 15% Jeevamrut significantly enhanced plant height, dry matter accumulation at 25 DAS, 50 DAS, and harvest, number of effective root nodules per plant, chlorophyll content of fresh leaves at 40 DAS, branches per plant, pods per plant, seeds per pod, nutrient (N, P, and K) concentration and uptake in seed and haulm, as well as seed protein content compared with the control and 5% Jeevamrut treatments. The highest seed and haulm yields were also recorded with 15% Jeevamrut, which remained statistically at par with the 10% Jeevamrut treatment. The maximum economic return, with a net income of ₹67,133 ha^{-1} and a benefit-cost ratio of 1.90, was obtained under the 15% Jeevamrut treatment. However, Jeevamrut application did not produce any significant effect on test weight, harvest index, or soil organic carbon after crop harvest.

Keywords: (*Vigna radiata* L.), RMG-492, Jeevamrut, Rajasthan, soil organic carbon

Introduction
Organic farming is a sustainable agricultural production system that emphasizes ecological balance, biodiversity, and natural biological processes to maintain soil fertility, ecosystem stability, and human health (IFOAM, 2008). At present, organic agriculture is practiced in nearly 190 countries, covering approximately 99 million hectares and involving over 4.3 million farmers worldwide (FiBL, 2025). According to the FiBL (2024) report, India ranks second globally in organic cultivated area and first in the number of organic producers.
Growing awareness regarding the adverse environmental and health impacts of excessive chemical fertilizer and pesticide use has increased consumer demand for organically produced food. Consequently, governments are encouraging organic farming to restore soil health, promote environmental sustainability, and strengthen rural livelihoods. Globally, about 76.4 million hectares were under organic management, including conversion areas, while the organic food market reached approximately US$125 billion (FiBL and IFOAM, 2023). India possesses nearly 7.3 million hectares under organic certification, including both cultivated and wild-certified areas. Among the states, Madhya Pradesh, Maharashtra, Gujarat, and Rajasthan together account for nearly 75% of India's organically cultivated land. Organic farming is increasingly recognized as a viable approach to ensure food security while improving soil fertility and enhancing soil carbon sequestration.
Green gram (*Vigna radiata* L.), commonly known as mung bean, is one of the most important pulse crops cultivated in India and ranks fourth after chickpea, pigeonpea, and black gram. The country's projected pulse requirement is expected to reach 32 million tonnes by 2030 (IIPR, 2011). Green gram is highly valued because of its nutritional quality, digestibility, and consumer preference. Being a short-duration crop, it integrates efficiently into rice-wheat cropping systems, providing an additional source of farm income. During 2023, green gram occupied 5.5 million hectares in India, producing 3.67 million tonnes with an average productivity of 663 kg ha^{-1}. In Rajasthan, the crop covered 2.33 million hectares, producing 1.17 million tonnes with an average yield of 505 kg ha^{-1} (Economic Survey, 2023).

Organic liquid formulations such as Jeevamrut, Beejamrut, and Panchgavya are fermented bio-inputs prepared from locally available farm resources. These formulations contain beneficial microorganisms that stimulate plant growth, improve nutrient availability, and enhance crop productivity. Organic materials including bran, oil cakes, and farmyard manure provide an excellent medium for microbial multiplication (Devakumar *et al*., 2011) [8]. Earlier studies have demonstrated that Jeevamrut and Beejamrut contain a wide range of beneficial microorganisms, including nitrogen-fixing bacteria, phosphorus-solubilizing microbes, actinomycetes, and fungi, which contribute to improved soil fertility and plant growth (Devakumar *et al*., 2008; Sreenivasa *et al*., 2011) [8, 31]. Liquid organic manures possess the advantage of rapid absorption by plants due to their water-soluble nature. Foliar application enables plants to absorb nutrients much faster than soil application, thereby correcting temporary nutrient deficiencies efficiently. Additionally, these formulations contain natural growth-promoting substances and compounds that enhance plant immunity, leading to improved crop growth and productivity (Bhawariya *et al*., 2022; Sreenivasa *et al*., 2011) [3, 31].

Materials and Methods

A field investigation entitled "Impact of Jeevamrut on Growth, Yield and Quality of Green Gram (*Vigna radiata* L.)" was conducted during the kharif season of 2025 at the Agronomy Farm, Vivekananda Global University, Jaipur, Rajasthan. The experimental soil was loamy sand in texture with available nitrogen, phosphorus, and potassium contents of 127.70, 16.65, and 153.24 kg ha^{-1}, respectively, in the 0–30 cm soil layer and had a soil pH of 8.2.

The experiment was laid out in a Factorial Randomized Block Design (FRBD) with three replications, comprising 20 treatment combinations. Treatments consisted of four Jeevamrut concentrations (control, 5%, 10%, and 15%) and five application schedules (15 DAS, 30 DAS, 45 DAS, 15 & 30 DAS, and 30 & 45 DAS). The green gram variety RMG-492 was sown on 9 July 2025 at a spacing of 30 cm × 10 cm using the recommended seed rate of 12 kg ha^{-1}.

Jaipur generally receives an annual rainfall of 400–500 mm, of which nearly 80–85% occurs during the southwest monsoon from July to early September. During the experimental season, total rainfall amounted to 735.30 mm, with the highest rainfall occurring in August. Maximum temperatures ranged from 31.41°C to 38.71°C, while minimum temperatures varied between 23.54°C and 27.85°C. Relative humidity fluctuated from 75% to 97%, and average daily sunshine hours ranged from 0.68 to 8.42 hours. Experimental observations were analyzed using standard statistical procedures as described by Panse and Sukhatme (1985) [24].

Results and Discussion

The experimental observations recorded during the study were evaluated to determine the effects of different Jeevamrut concentrations and application schedules on the growth, yield, and quality of green gram. Significant treatment effects were analyzed and interpreted in relation to previous research findings. The discussion integrates the experimental results with published literature to provide a comprehensive understanding of the influence of Jeevamrut on crop performance. The findings are presented under appropriate headings covering growth, yield attributes, yield, quality parameters, nutrient uptake, and economics.

Growth attributes

The results indicated that varying concentrations of Jeevamrut significantly affected the growth and biomass production of green gram throughout the crop growth period. All the growth parameters were positively influenced by increasing the concentration of Jeevamrut. The application of 15% Jeevamrut recorded significantly greater plant heights of 29.53 cm, 57.15 cm, and 69.29 cm at 25 DAS, 50 DAS, and harvest, respectively, which remained statistically at par with the 10% Jeevamrut treatment. Likewise, the highest dry matter accumulation of 3.02, 8.55, and 13.63 g plant^{-1} at 25 DAS, 50 DAS, and harvest, respectively, was observed under the 15% Jeevamrut treatment, showing statistical equivalence with 10% Jeevamrut. The same treatment also produced the highest number of effective root nodules (26.97 plant^{-1}) and maximum chlorophyll content of fresh leaves (3.02 mg g^{-1}) at 40 DAS, which were comparable with the 10% Jeevamrut treatment. The improvement in plant height and dry matter accumulation with higher Jeevamrut concentration may be attributed to enhanced nutrient availability during the early growth stages through organic inputs, along with the additional benefits provided by Jeevamrut. Being a fermented liquid organic formulation, Jeevamrut contains a diverse population of beneficial microorganisms, essential nutrients, and plant growth-promoting substances that enhance metabolic activity, stimulate vegetative growth, and improve resistance against pests and diseases (Bhadu *et al*., 2021) [2]. Increased dry matter production may also be associated with greater leaf area development throughout the crop growth period, resulting in improved photosynthetic efficiency (Bhadu *et al*., 2021) [2].

The beneficial effects of Jeevamrut reported by Palekar (2006), Vasanthkumar (2006), and Devakumar *et al*. (2008) [8, 23, 33] support the findings of the present investigation. Jeevamrut facilitates rapid absorption of essential nutrients such as nitrogen and magnesium through leaf tissues, which play a vital role in chlorophyll synthesis and photosynthetic enzyme activity. In addition, its microbial population synthesizes plant growth regulators, including auxins, gibberellins, and cytokinins, which promote leaf expansion, chloroplast development, and chlorophyll accumulation (Kumari *et al*., 2023) [23]. Enhanced microbial activity also improves nitrate assimilation by stimulating nitrate reductase activity, thereby promoting chlorophyll biosynthesis and greener foliage. Improved physiological activity subsequently enhances root growth and effective nodule formation in green gram. Increased nodulation improves biological nitrogen fixation, resulting in greater chlorophyll production and enhanced crop growth (Saini *et al*., 2024) [27]. Furthermore, the higher microbial population and naturally occurring growth-promoting compounds in Jeevamrut improve soil biological activity, sustain nutrient availability, and enhance the uptake of both applied and native soil nutrients, ultimately contributing to better crop growth and productivity. Similar findings have been reported by Yogananda *et al*. (2015), Boraiah (2013), and Sutar *et al*. (2023) [34, 4, 32], who attributed improvements in crop growth to increased nutrient solubilization, moisture availability, and efficient nutrient absorption following Jeevamrut application.

Time of Application

The results further revealed that the timing of Jeevamrut application significantly influenced the growth performance of green gram. Growth parameters including plant height, dry matter accumulation at 25 DAS, 50 DAS, and harvest, as well as the number of effective root nodules and chlorophyll content of fresh leaves at 40 DAS, showed improvement under different application schedules, namely 15 DAS, 30 DAS, 45 DAS, 15 & 30 DAS, and 30 & 45 DAS. Application of Jeevamrut at 15 and 30 DAS produced the highest plant height and dry matter accumulation at 25 DAS, while application at 15 DAS alone ranked second for these parameters. At the later stages of crop growth, the 30 and 45 DAS application schedule recorded the maximum plant height and dry matter accumulation at 50 DAS and at harvest, which remained statistically comparable with the 15 and 30 DAS treatment. Moreover, the application of Jeevamrut at 15 and 30 DAS resulted in the highest chlorophyll content of fresh leaves and the greatest number of effective root nodules at 40 DAS (Tables 4.3 and 4.4).

The positive response to the timing of Jeevamrut application may be explained by its synchronization with the critical growth stages of green gram. Foliar application at 15 DAS, 30 DAS, and 45 DAS coincides with active vegetative growth, root nodule development, and early flowering, respectively, when the crop exhibits a greater demand for nutrients. Application of Jeevamrut during these stages ensures a continuous supply of essential nutrients such as nitrogen and magnesium, together with naturally occurring plant growth regulators, thereby improving chlorophyll synthesis and photosynthetic efficiency (Kumari *et al*., 2023) [20]. In addition, the beneficial microorganisms present in Jeevamrut stimulate root nodulation and biological nitrogen fixation, which further enhance chlorophyll production and overall crop growth (Kason *et al*., 2024) [19].

These findings are in agreement with those of Kurubetta *et al*. (2017) [21], who reported significantly improved bulb weight and bulb girth in onion following the application of 100% recommended fertilizer dose along with Jeevamrut at planting, vegetative, and bulb initiation stages. Similarly, Sutar *et al*. (2019) [32] observed that the combined application of Jeevamrut and Panchagavya enhanced crop growth attributes while simultaneously improving soil fertility status.

Yield attributes and yield

The application of different concentrations of Jeevamrut significantly influenced the yield attributes of green gram, including the number of branches per plant, number of pods per plant, number of seeds per pod, and seed yield. Among the treatments, foliar application of 15% Jeevamrut recorded significantly superior yield attributes compared to the control and 5% Jeevamrut treatments, while remaining statistically at par with the 10% Jeevamrut treatment.

Application of 15% Jeevamrut resulted in the highest seed yield (957 kg ha^{-1}), representing an increase of 20.07% over the control (797 kg ha^{-1}). Likewise, the maximum haulm yield (2227 kg ha^{-1}) was also obtained with the 15% Jeevamrut treatment, which was 20.63% higher than the control (1846 kg ha^{-1}). The enhanced seed and haulm yields obtained under the 15% Jeevamrut treatment may be attributed to improved nutrient availability and a continuous supply of plant growth-promoting substances during the critical stages of crop development. These observations are consistent with the findings of Kasbe *et al*. (2009) [18], who reported that the application of Jeevamrut (2500 L ha^{-1}) improved nutrient availability, resulting in greater dry matter production and higher yield attributes. Similar results were also reported by Shwetha (2008) [28], who observed a 25–35% increase in soybean seed yield following the combined application of Beejamrut, Jeevamrut, Panchagavya, and organic manures. The significantly higher seed yield associated with the 15% Jeevamrut treatment was primarily due to improvements in important yield-contributing characters such as the number of branches per plant, pods per plant, and seeds per pod. The superior performance may be attributed to the presence of naturally occurring plant growth regulators, including indole acetic acid (IAA) and gibberellic acid (GA_3), along with macro- and micronutrients and beneficial microorganisms present in the liquid organic formulation. Repeated application of liquid organic manures acts as a physiological stimulant, promoting endogenous production of growth regulators within plant tissues. Palekar (2006), Vasanthkumar (2006), and Devakumar *et al*. (2008) [8, 23, 33] also reported that the high microbial population and growth-promoting compounds in Jeevamrut improve soil biological activity, thereby enhancing nutrient availability and uptake from both applied and native soil sources, ultimately resulting in improved crop growth and productivity. Similar observations have also been documented by Bhadu *et al*. (2021) [2].

Time of Application

The timing of Jeevamrut application also exerted a significant influence on the yield attributes and yield of green gram. Application at 30 and 45 DAS produced significantly higher values for the number of branches per plant, pods per plant, seeds per pod, seed yield, and haulm yield compared with the other application schedules (Tables 4.5 and 4.6).

The higher productivity obtained with Jeevamrut application at 30 and 45 DAS may be attributed to the timely availability of essential nutrients and naturally occurring growth regulators during the critical reproductive stages of crop development. Adequate supply of nutrients such as nitrogen, phosphorus, potassium, sulphur, zinc, and iron during these stages likely enhanced photosynthetic activity, carbohydrate synthesis, and efficient translocation of assimilates towards developing reproductive organs. In addition, Jeevamrut stimulates the synthesis of plant growth-promoting substances, which contribute to improved vegetative growth, better yield attributes, and ultimately higher seed yield. These findings corroborate those of Kurubetta *et al*. (2017) [21], who reported enhanced growth and yield of onion through the application of the recommended fertilizer dose along with Jeevamrut (500 L ha^{-1}) at planting, vegetative, and bulb initiation stages. Similar results have also been reported by Jayaram Reddy and Reddy (2011), Maheshbabu *et al*. (2008), Siddaram (2012), and Sonawane *et al*. (2024) [16, 22, 29, 23].

Plant Analysis

Concentration of Jeevamrut

The results demonstrated that foliar application of Jeevamrut significantly improved the nitrogen, phosphorus, and potassium concentrations in both seed and haulm, as well as their total uptake by green gram compared with the control treatment. The highest nutrient concentrations were recorded with 15% Jeevamrut, registering 3.81% nitrogen and 1.77% nitrogen in seed and haulm, respectively. Similarly, phosphorus content reached 0.442% in seed and 0.251% in haulm, while potassium content increased to 0.949% in seed and 2.010% in haulm. These values remained statistically comparable with those obtained under the 10% Jeevamrut treatment.

Maximum uptake of nitrogen, phosphorus, and potassium by both seed and haulm was also observed under the 15% Jeevamrut treatment. This improvement can be attributed to enhanced microbial activity in the rhizosphere, leading to increased populations of beneficial bacteria, fungi, actinomycetes, nitrogen-fixing organisms, and phosphorus-solubilizing microorganisms. Improved microbial activity enhances nutrient mineralization and availability, thereby promoting greater nutrient absorption, improved plant growth, and higher biomass production.

These findings agree with Brijesh Singh (2008), who reported increased nitrogen, phosphorus, and potassium content in chilli fruits following the application of Jeevamrut, Beejamrut, and Panchgavya due to their rich microbial population and enzymatic activity. Siddaram (2012) [29] also observed significantly higher nutrient uptake in field bean with the application of farmyard manure combined with biodigester liquid manure equivalent to 35 kg N ha⁻¹. Similar findings have been reported by Reddy *et al*. (1992), Siddaram (2012), and Boraiah (2013) [29, 4].

Foliar application of 15% Jeevamrut also resulted in the highest seed protein content (28.81%), which may be attributed to increased nitrogen accumulation in plant tissues, as protein synthesis is directly associated with nitrogen availability. Comparable findings were reported by Desai *et al*. (2014).

Time of Application

The timing of Jeevamrut application significantly influenced nutrient concentration, nutrient uptake, and seed protein content. Application at 30 and 45 DAS recorded the highest nitrogen, phosphorus, and potassium concentrations and their uptake in both seed and haulm, although the results remained statistically at par with the 15 and 30 DAS treatment (Tables 4.7, 4.8, and 4.9).

Similarly, the highest protein content (23.91%) was observed with Jeevamrut application at 30 and 45 DAS, which was statistically comparable to the 15 and 30 DAS treatment and significantly superior to the remaining application schedules.

The enhanced nutrient content and uptake associated with these application timings may be attributed to the synchronized availability of nutrients during periods of maximum crop demand. Jeevamrut improves soil fertility by increasing microbial activity and enriching the soil with nitrogen-fixing and phosphorus-solubilizing microorganisms, thereby enhancing nutrient availability and absorption. Improved nutrient uptake subsequently promotes better crop growth, yield, and quality. Similar observations have been reported by Sutar *et al*. (2019) [32].

The increase in nutrient uptake and growth parameters may also be attributed to enhanced nutrient solubilization, efficient moisture utilization, and improved root absorption following Jeevamrut application, as reported by Yogananda *et al*. (2015) [34], and Ananda *et al*. (2017) [1]. Furthermore, Chaudhary *et al*. (2022) [6] reported that Jeevamrut application through irrigation improves metabolic and photosynthetic activities, encouraging deeper root development and greater nutrient extraction from the soil. Enhanced carbohydrate accumulation and dry matter production resulting from these physiological improvements have also been reported by Bhadu *et al*. (2021) and Bhawariya *et al*. (2022) [2, 3].

Soil Analysis

Application of Jeevamrut did not produce a significant effect on soil organic carbon content after harvest compared with the control treatment. This may be attributed to the uniform application of the recommended dose of vermicompost as a basal treatment across all experimental plots, which ensured an adequate and balanced nutrient supply and maintained soil fertility throughout the cropping period. Consequently, post-harvest soil organic carbon remained statistically similar among the treatments.

Furthermore, the principal role of Jeevamrut appears to be as a biological stimulant and plant growth regulator rather than a major source of nutrients. Since it was applied as a foliar spray, Jeevamrut primarily enhanced physiological and biochemical processes during critical crop growth stages by supplying small quantities of nutrients together with beneficial microorganisms and growth-promoting substances, without substantially altering the soil organic carbon status.

Economics

Concentration of jeevamrut: The economic analysis revealed that different concentrations of Jeevamrut significantly influenced the profitability of green gram cultivation. Among the treatments, foliar application of 15% Jeevamrut recorded the highest net return (₹66,133 ha⁻¹) and benefit-cost ratio (1.90), which were superior to those obtained under the control and other Jeevamrut concentrations (Table 4.11). The enhanced economic returns achieved with the 15% Jeevamrut treatment can be attributed to its significantly higher seed yield (957 kg ha⁻¹) and haulm yield (2227 kg ha⁻¹), which ultimately increased the gross monetary returns. In contrast, the control treatment recorded the lowest net return (₹49,394 ha⁻¹).

The higher profitability associated with Jeevamrut application indicates that it is a cost-effective and efficient organic input that can be successfully integrated with other organic nutrient sources, such as vermicompost, to enhance crop productivity and farm income while simultaneously improving soil fertility. Similar observations were reported by Kasbe *et al*. (2009) [18], who concluded that Jeevamrut is an economical organic supplement capable of increasing crop yield and profitability. The present findings are also in agreement with those reported by Boraiah (2013) and Deshmukh *et al*. (2010) [4, 7].

Time of Application

The timing of Jeevamrut application also had a significant effect on the economics of green gram cultivation. Application of Jeevamrut at 30 and 45 DAS resulted in the highest net return (₹65,843 ha⁻¹) and benefit-cost ratio (1.89) compared with the other application schedules (Table 4.11). The superior economic performance under the 30 and 45 DAS application schedule may be attributed to the higher seed and haulm yields obtained through timely nutrient supply and enhanced crop growth during the critical stages of development. Increased productivity under this treatment translated directly into higher gross and net returns, thereby improving overall profitability. These findings are consistent with those of Patil and Udmale (2016) [25], who reported improved economic returns in soybean following Jeevamrut application, and Ananda *et al*. (2017) [1], who observed similar benefits in black gram. Likewise, Divya and Mahapatra (2015) [10] also reported higher net returns with the use of organic nutrient management practices involving liquid organic formulations.

Table 1: Effect of concentrations of jeevamrut and time of application on yield attributes of green gram.

Treatments	Yield attributes: Number of branches/plant	Number of pods/plant	Number of seeds/plant	Test weight (g)
Concentration of jeevamrut				
Control (Water spray)	6.35	25.33	9.29	30.90
5% jeevamrut	6.97	28.45	10.27	31.80
10% jeevamrut	7.31	29.91	10.77	32.06
15% jeevamrut	7.50	30.38	11.19	32.51
S.Em ±	0.14	0.52	0.19	0.51
CD (P=0.05)	0.39	1.49	0.55	NS
Time of application				
15 DAS	6.36	25.98	9.35	31.15
30 DAS	6.97	28.37	10.28	31.25
45 DAS	6.82	27.78	9.98	31.37
15 & 30 DAS	7.42	30.01	10.94	32.68
30 & 45 DAS	7.60	30.47	11.36	32.64
S.Em ±	0.15	0.58	0.22	0.57
CD (P=0.05)	0.44	1.66	0.62	NS
CV (%)	7.54	7.06	7.20	6.20

Table 2: Effect of concentrations of jeevamrut and time of application on yield and harvest index of green gram.

Treatments		Yield (kg/ha)		Harvest index (%)
	Seed yield	Haulm yield	Biological yield	
Concentration of jeevamrut				
Control (Water spray)	797	1846	2644	30.17
5% jeevamrut	866	2052	2919	29.74
10% jeevamrut	909	2132	3041	29.90
15% jeevamrut	957	2227	3184	30.13
S.Em ±	18.12	43.65	54	0.49
CD (P=0.05)	51.88	124.95	153.85	NS
Time of application				
15 DAS	809	1861	2670	30.36
30 DAS	881	2063	2944	29.91
45 DAS	868	2037	2905	29.85
15 & 30 DAS	903	2123	3026	29.88
30 & 45 DAS	953	2236	3189	29.92
S.Em ±	20.26	48.80	60.08	0.55
CD (P=0.05)	58.00	139.70	172.01	NS
CV (%)	7.95	8.19	7.06	6.34

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