

INFLUENCE OF ORGANIC NUTRIENT FORMULATIONS ON GROWTH, YIELD AND QUALITY OF SUMMER COWPEA IN VERTISOLS

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ABSTRACT

Because of its nutritional content and adaptability, cowpea (*Vigna unguiculata* (L.) Walp.) is a major food legume grown in arid and semi-arid regions. To assess the impact of *ghanajeevamrutha* and *jeevamrutha* on the growth, yield, and quality of cowpea grown in Vertisols, a field experiment was carried out during the summer 2022 at the College of Agriculture, Vijayapura, Karnataka. With thirteen treatments, the field experiment was set up in a Randomized Complete Block Design. The data revealed that a taller plants (57.42 cm), a greater number of branches plant⁻¹ (26.83), leaf area (68.83 dm²plant⁻¹), and leaf area index (1.530) when *ghanajeevamrutha* at 2000 kg ha⁻¹ was applied to the soil together with 20% foliar spray of *jeevamrutha*. The same treatment resulted in increased seed yield (1625 kg ha⁻¹) and haulm yield (3432 kg ha⁻¹). It greatly increased protein content (20.92%) and protein yield (339 kg ha⁻¹). The study reveals that combining *ghanajeevamrutha* and *jeevamrutha* can enhance growth, yield, and quality of summer cowpea in the northern Karnataka.

(Key words: Natural farming, *jeevamrutha*, *ghanajeevamrutha*, soil biological activity, protein yield)

INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp.) is an important food legume that is widely cultivated in tropical and subtropical regions. It plays an important role in the diet of rural populations and is often referred to as poor man's meat because of its high protein content. Cowpea is also known as a hunger season crop because it provides food during periods of scarcity. It adapts well to diverse soil types and rainfall conditions, making it suitable for cropping systems in arid and semi-arid regions of Africa and Asia. Cowpea, a member of the Leguminosae family and the genus *Vigna*, is valued for its protein-rich grains, notably their high lysine content. It is consumed as dry grain or green pods, while its haulm serves as nutritious livestock fodder. Cowpea grains contain about 23.14% protein, 56.8% carbohydrates, 3.9% fiber, 3.20% ash, and 1.3% fat, along with minerals such as calcium (0.08-0.11%) and iron (0.005%) (Phillips and McWatters, 1991).

India is a large producer of cowpea, with an area of about 3.9 million hectares and production of 2.2 million tonnes, with an average productivity of 600-750 kg ha⁻¹. In Karnataka, the crop covers about 0.88 lakh hectares with a production of 0.42 lakh tonnes and an average productivity of 420 kg ha⁻¹ (Anonymous, 2019). Despite its adaptability

and nutritional value, productivity remains low, highlighting the need for better nutrient management strategies.

Natural farming has becoming more popular due to its ability to improve crop productivity and quality, while it enhancing soil health. It emphasizes the usage of locally available inputs such as *beejamrutha*, *jeevamrutha*, *ghanajeevamrutha*, mulching, and moisture conservation practices, which enhance soil biological activity and support sustainable crop production. Among these, *jeevamrutha* and *ghanajeevamrutha* are gaining importance as they stimulate microbial activity and improve nutrient availability by increasing organic matter decomposition. *Ghanajeevamrutha*, a solid organic formulation, provides nutrients and promotes beneficial soil organisms such as earthworms and microbes, boosting soil aeration and nutrient availability. Liquid organic formulations also assist in supplying crop nutrient needs throughout critical growth stages and can correct nutrient deficiencies in organic production systems (Shwetha, 2008). *Beejamrutha*, *jeevamrutha*, and *panchagavya* are prepared from desi cow dung, desi cow urine, milk, curd, ghee, pulse flour and jaggery. Despite their widespread promotion in natural farming, systematic evaluation of these formulations in field crops like cowpea is scarce. As a result, the present study was undertaken to evaluate the combined effects of *ghanajeevamrutha* and *jeevamrutha* on growth, yield and

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quality of summer cowpea grown in Vertisols of the northern Karnataka.

MATERIALS AND METHODS

Experimental site and treatments

A field experiment was carried out during the summer season of 2022 at the Research Farm of College of Agriculture, Vijayapura, Karnataka. The experimental field was consisted of Vertisol soil with a soil reaction (pH) of 8.27 and an electrical conductivity (EC) of 0.39 dS m⁻¹. The soil had 0.52 per cent organic carbon and was low in nitrogen availability (174 kg ha⁻¹), medium phosphorus (30.50 kg P₂O₅ ha⁻¹), and high potassium availability (418 kg K₂O ha⁻¹).

The experimental field was located at 16°77' N latitude and 75°74' E longitude with an elevation of 516.29 meters above mean sea level. During the cropping season, a total rainfall of 71.6 mm was recorded, which was lower than the average seasonal rainfall. The month of April had the greatest rainfall throughout the experimental year (71.2 mm).

The experiment followed a randomized complete block design with three replications and thirteen treatments. The treatments consisted of varying levels of *ghanajeevamrutha* and *jeevamrutha* applied individually and in combination. The treatments were: T₁: *Ghanajeevamrutha* at 1000 kg ha⁻¹; T₂: *Ghanajeevamrutha* at 1500 kg ha⁻¹; T₃: *Ghanajeevamrutha* at 2000 kg ha⁻¹; T₄: Foliar application of *jeevamrutha* at 10%; T₅: Foliar application of *jeevamrutha* at 20%; T₆: T₁ + foliar application of *jeevamrutha* at 10%; T₇: T₁ + foliar application of *jeevamrutha* at 20%; T₈: T₂ + foliar application of *jeevamrutha* at 10%; T₉: T₂ + foliar application of *jeevamrutha* at 20%; T₁₀: T₃ + foliar application of *jeevamrutha* at 10%; T₁₁: T₃ + foliar application of *jeevamrutha* at 20%; T₁₂: RPP (5 t FYM + 25 kg N + 50 kg P₂O₅ + 25 kg K₂O + 20 kg S + 25 kg ZnSO₄ ha⁻¹); T₁₃: Absolute control.

Preparation and application of *jeevamrutha* and *ghanajeevamrutha*

Ghanajeevamrutha was prepared using 100 kg of dried desi cow dung spread on a polythene sheet. 10 liters of cow urine, 2 kg of powdered jaggery and 2 kg of pulse flour were added to cow dung and thoroughly mixed. The mixture was covered with a moist gunny bag and kept under shade to keep it at about 60% moisture. The material was turned two times every day for seven days to ensure proper aeration and microbial activity. After seven days, the prepared *ghanajeevamrutha* was ready for use and applied to the soil as a basal application at sowing, as per treatments.

Jeevamrutha was prepared by using 10 kg of desi cow dung, 10 liters of cow urine, 2 kg of jaggery, 2 kg of pulse flour, and a handful field bund soil. These ingredients were placed in a 200-liter plastic drum, and water was added to bring the volume up to 200 liters. The mixture was stirred

thoroughly to ensure uniform mixing and was stirred thrice day⁻¹ with a wooden stick. The container was kept in shade and covered with a moist gunny bag for fermentation. The prepared *jeevamrutha* was applied in two equal portions based on the treatments, first at flowering and second at the pod development stage.

Crop management and recording observations

The cowpea variety Dharwad Cowpea-15 (DC-15) was used for the experiment. On January 1, 2022, the cowpea was sown with a spacing of 45 cm × 10 cm in plots measuring 4.5 m × 4 m. Irrigation was applied at 15-20 day intervals with a sprinkler system based on crop growth stage and soil moisture conditions.

The growth attributes *viz.*, plant height, branches plant⁻¹, and total dry matter plant⁻¹ were recorded at 30, 60 DAS and at harvest. The leaf area plant⁻¹ was measured at 30 and 60 DAS. Yield attributes including seed and haulm yield were recorded from the net plot area and represented in kg ha⁻¹. The protein content was determined by multiplying the nitrogen content by a factor of 6.25. Protein yield (kg ha⁻¹) was determined with following formula:

Protein yield = (Protein content × seed yield) / 100

Statistical analysis

The experimental data collected at various growth stages and at harvest were statistically analysed using the standard procedures. The F test was used at a 0.05 probability level to determine the significance of treatment effects. The critical difference was computed at the 5% level to compare treatment means in cases when treatment effects was significant.

RESULTS AND DISCUSSION

Effect of *ghanajeevamrutha* and *jeevamrutha* on growth attributes

The soil and foliar application of organic inputs have significantly affected the cowpea growth attributes. Among the treatments, soil application of *ghanajeevamrutha* at 2000 kg ha⁻¹ combined with foliar spray of *jeevamrutha* at 20% (T₁₁) resulted in the tallest plants at harvest (57.42 cm) and the maximum branches plant⁻¹ at harvest (26.83). This treatment was followed by T₁₀ (*ghanajeevamrutha* 2000 kg ha⁻¹ + *jeevamrutha* 10%) and the recommended package of practices (T₁₂), which recorded plant heights of 56.39 cm, 56.22 cm, and 25.36 and 25.07 branches plant⁻¹, respectively. The absolute control resulted in the lowest growth parameters (46.05 cm plant height and 18.52 branches plant⁻¹) (Table 1). Higher levels of *ghanajeevamrutha* and *jeevamrutha* may boost vegetative development due to increased availability of critical nutrients and physiologically active chemicals found in these formulations. These organic inputs are known to boost microbial activity and plant metabolic processes, perhaps promoting cell proliferation and elongation. Ramesh *et al.* (2015) showed similar results to the use of liquid organic

compositions. Kaur *et al.* (2025) found that applying 15 t FYM ha⁻¹, 3 t poultry manure ha⁻¹ and 2 t vermicompost ha⁻¹ resulted in considerably greater plant height in basil.

The total dry matter plant⁻¹ differed considerably across the treatments. The treatment T₁₁ had the highest dry matter, with 24.03 g plant⁻¹ at 60 DAS and 38.64 g plant⁻¹ at harvest, while the absolute control (T₁₃) had 15.61 g and 23.94 g, respectively (Table 2). The increased biomass under organic treatments could be attributed to increase microbial activity and nutrient availability in the rhizosphere, resulting in better photosynthesis and assimilate translocation. Upendranaik *et al.* (2018) reported similar findings. The use of organic formulations greatly alters the leaf development. The treatment T₁₁, which received soil application of *ghanajeevamrutha* at 2000 kg ha⁻¹ and foliar spray of *jeevamrutha* at 20%, had the highest leaf area (68.83 dm² plant⁻¹) and leaf area index (1.530) at 60 DAS when compared to other treatments (Table 2). However, these parameters were non-significant at 30 DAS. The increase in leaf area could be attributed to better nutrient availability and physiological activity due to the combined application of soil and foliar organic inputs. Leaf expansion and the production of photosynthetically active tissues may have increased as a result of enhanced vegetative growth. Similar results were reported by Shafiq *et al.* (2025), who found that a foliar spray of an organic formulation, such as *panchagavya* (5%), sprayed during flower initiation and early pod formation stage, increased the LAI in green gram.

Effect of *ghanajeevamrutha* and *jeevamrutha* on yield attributes

Significant changes in seed yield were observed across treatments. Maximum seed yield (1625 kg ha⁻¹) was reported with the soil application of *ghanajeevamrutha* at 2000 kg ha⁻¹ combined with foliar spray of *jeevamrutha* at 20% (T₁₁), followed by *ghanajeevamrutha* at 2000 kg ha⁻¹ with *jeevamrutha* at 10% (T₁₀) (1567 kg ha⁻¹). The lowest seed yield (902 kg ha⁻¹) was recorded in the absolute control (Fig. 1). Higher seed yield in treatments that included both *ghanajeevamrutha* and *jeevamrutha* could be attributable to improve soil fertility, greater nutrient uptake, and increased soil microbial activity. These factors collectively contribute to improving crop development and assimilates partitioning towards reproductive structures. Kumbar *et al.* (2015) found that applying *jeevamrutha* (1000 l ha⁻¹) to the soil and spraying *panchagavya* (3%) on the foliage increased

the yield attributes of French bean. Haulm yield followed a trend similar to seed yield. The highest haulm yield (3432 kg ha⁻¹) was produced with combined application of *ghanajeevamrutha* at 2000 kg ha⁻¹ and foliar spray of *jeevamrutha* at 20% (T₁₁), followed by *ghanajeevamrutha* at 2000 kg ha⁻¹ with *jeevamrutha* at 10% (T₁₀) (3352 kg ha⁻¹), while the lesser haulm yield (2097 kg ha⁻¹) was found with absolute control (Fig. 1). The increased haulm yield production could be due to improved nutrient availability and vegetative growth under organic inputs. Saraswathi *et al.* (2022) found that applying *ghanajeevamrutha* (10 t ha⁻¹) and foliar sprays with 10% *jeevamrutha* increased the chickpea grain and haulm yield. Likewise, foliar application of *panchagavya* also increased grain and biological yield in cowpea (Patel *et al.*, 2025; Jinjala *et al.*, 2025).

Effect of *ghanajeevamrutha* and *jeevamrutha* on crop quality parameters

The treatments considerably altered the protein content and protein yield of cowpea. Table 3 showed that the protein content varied from 14.97 to 20.92%. The maximum protein yield (339 kg ha⁻¹) was observed with a combined treatment of *ghanajeevamrutha* at 2000 kg ha⁻¹ and foliar spray of *jeevamrutha* at 20% (T₁₁), which was comparable statistically to *ghanajeevamrutha* at 2000 kg ha⁻¹ + *jeevamrutha* at 10% (T₁₀) (321 kg ha⁻¹) and the recommended package of practices (T₁₂) (306 kg ha⁻¹). The absolute control (T₁₃) had the lowest protein yield (135 kg ha⁻¹). The higher protein yield may be attributed to improve nitrogen availability through organic inputs, which plays a significant part in amino acid synthesis and protein formation in seeds. Siddappa (2015) reported similar finding, observing increased growth and seed yield in field bean with FYM (150% N equivalent) and 1500 l ha⁻¹ of *jeevamrutha* application. Likewise, Kumar *et al.* (2022) and Soni *et al.* (2025) reported higher yields in legumes with integrated nutrient application and bioinoculant seed treatment.

The study concluded that application of *ghanajeevamrutha* and *jeevamrutha* significantly improved growth, yield and protein content of summer cowpea. Maximum productivity was achieved when *ghanajeevamrutha* was applied to the soil at 2000 kg ha⁻¹ and foliar spray of *jeevamrutha* at 20%. As a result, their combined application can be advised to increase cowpea yield under the Northern Dry Zone of Karnataka.

Table 1. Plant height and branches of summer cowpea as influenced by *ghanajeevamrutha* and *jeevamrutha*

Treatments	Plant height (cm)			Number of branches		
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
T ₁	15.29	42.20	49.78	3.54	13.83	21.48
T ₂	15.71	43.87	51.12	3.90	14.13	22.01
T ₃	15.87	46.01	53.15	4.10	14.76	23.16
T ₄	14.46	39.05	47.07	3.27	12.43	19.05
T ₅	14.54	40.24	47.95	3.40	12.92	20.30
T ₆	15.27	43.83	51.51	3.60	14.03	22.85
T ₇	15.09	45.03	52.87	3.56	14.47	22.65
T ₈	15.66	46.70	54.42	3.84	15.00	23.36
T ₉	15.79	48.23	55.70	3.96	15.83	23.91
T ₁₀	15.82	50.09	56.39	4.07	16.08	25.36
T ₁₁	15.89	52.05	57.42	4.13	16.79	26.83
T ₁₂	15.93	49.70	56.22	4.20	16.00	25.07
T ₁₃	14.41	37.80	46.05	3.33	11.43	18.52
S.Em±	0.50	1.48	1.65	0.23	0.54	0.75
CD at 5%	-	4.42	4.94	-	1.61	2.19

RPP-Recommended package of practice; DAS-Days after sowing; - Non-significant

Table 2. Dry matter, leaf area, LAI and protein yield of summer cowpea as influenced by *ghanajeevamrutha* and *jeevamrutha*

Treatments	Total dry matter accumulation (g plant ⁻¹)			Leaf area (dm ²) plant ⁻¹		Leaf area index (LAI)		Crude protein (%)	Protein yield (kg ha ⁻¹)
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	30 DAS	60 DAS		
T ₁	1.99	17.51	26.00	4.36	55.95	0.097	1.243	17.38	202
T ₂	2.12	18.54	28.48	4.42	58.86	0.098	1.308	18.31	225
T ₃	2.36	20.27	29.55	4.54	61.11	0.101	1.358	19.28	255
T ₄	1.87	16.36	24.85	3.94	54.08	0.088	1.202	15.74	162
T ₅	1.80	17.18	25.94	3.90	55.41	0.087	1.231	16.03	169
T ₆	2.06	18.76	33.17	4.38	56.95	0.097	1.266	18.33	253
T ₇	2.06	19.47	34.40	4.36	57.68	0.097	1.282	18.63	261
T ₈	2.19	20.52	35.50	4.45	59.11	0.099	1.314	19.36	281
T ₉	2.21	21.68	36.58	4.47	63.69	0.099	1.415	19.68	297
T ₁₀	2.29	23.16	37.52	4.52	66.71	0.100	1.482	20.52	321
T ₁₁	2.34	24.03	38.64	4.54	68.83	0.101	1.530	20.92	339
T ₁₂	2.40	22.69	36.70	4.67	66.34	0.104	1.474	20.08	306
T ₁₃	1.81	15.61	23.94	3.88	53.26	0.086	1.184	14.97	135
S.Em±	0.15	0.61	0.91	0.18	2.33	0.004	0.05	1.27	17.73
CD at 5%	-	1.82	2.72	-	6.97	-	0.15	-	53.01

RPP-Recommended package of practice; DAS-Days after sowing; - Non-significant

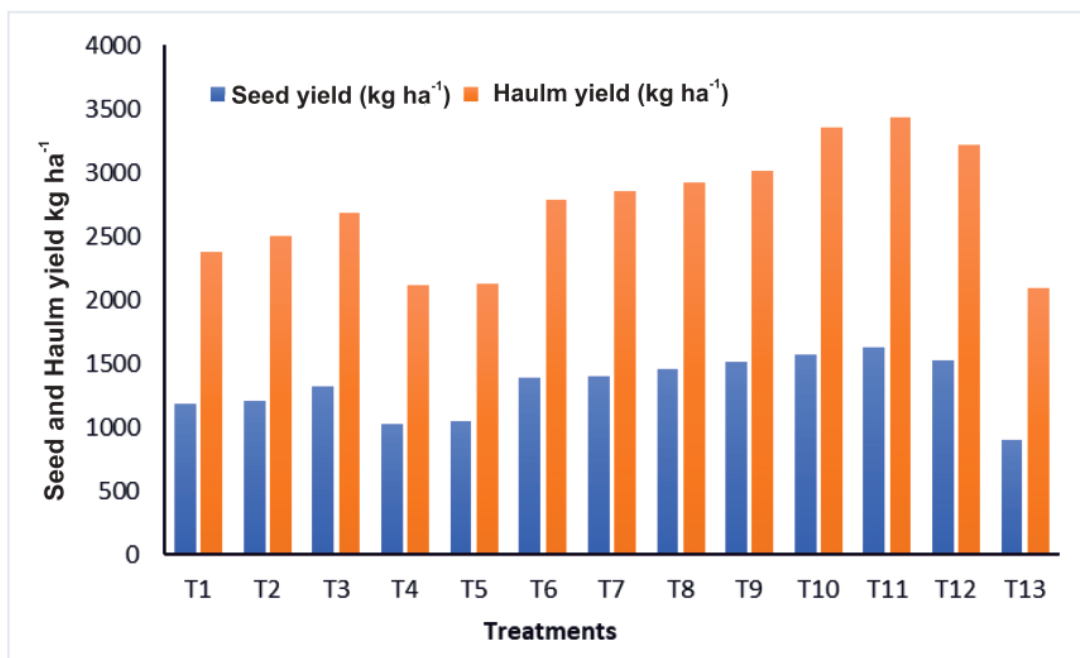


Figure 1. Seed and haulm yield of summer cowpea as influenced by *ghanajeevamrutha* and *jeevamrutha*

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