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Comparative evaluation of natural farming and inorganic nutrient management practices on growth and yield of cowpea

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Abstract

A field experiment was conducted during 2024–25 and 2025–26 to evaluate the comparative performance of natural farming and inorganic nutrient management practices on growth and yield of cowpea (*Vigna unguiculata* (L.) Walp.). The experiment comprised 12 nutrient management treatments laid out in a Randomized Block Design with three replications. The treatments included recommended dose of inorganic fertilizers, reduced fertilizer application with FYM, different combinations of Ghanjeevamrit and Jeevamrit, nutrient omission treatments and an absolute control. Pooled analysis revealed that the number of shoots plant⁻¹ and pods plant⁻¹ were not significantly affected by the treatments, whereas the number of leaves plant⁻¹ and yield per plot showed significant differences. The highest number of leaves (30.17 plant⁻¹) and yield (12.59 kg plot⁻¹) were recorded under 100% recommended dose of NPK (T₁), while the absolute control recorded the lowest values. Among the natural farming treatments, Ghanjeevamrit @ 1500 kg ha⁻¹ + Jeevamrit through irrigation twice a month (T₆) performed comparatively better, recording 22.10 leaves plant⁻¹ and 9.14 kg plot⁻¹ yield. The results indicated that balanced inorganic nutrient application provided superior short-term growth and yield of cowpea, while the higher-dose Ghanjeevamrit-based treatment showed better performance among the natural farming practices. The findings highlight the potential of optimized natural farming inputs while emphasizing the need for further evaluation of their long-term effects on crop productivity and soil fertility.

Keywords: Cowpea, natural farming, nutrient management, inorganic fertilizer, Ghanjeevamrit, Jeevamrit, growth, yield, sustainable agriculture

Introduction

Cowpea (*Vigna unguiculata* (L.) Walp.) is an important pulse and vegetable crop valued for its edible pods, nutritional quality and biological nitrogen-fixing ability. Its suitability for diversified cropping systems makes it relevant to sustainable and resource-efficient agriculture. Crop growth and productivity are strongly influenced by the availability and balance of essential nutrients, particularly N, P and K.

Natural farming has gained attention as a low-input agroecological approach that relies on locally available biological inputs such as Jeevamrit, Ghanjeevamrit, Beejamrit and crop-residue mulching. These practices are expected to improve nutrient cycling, soil biological activity and resource-use efficiency while reducing dependence on synthetic fertilizers. However, the effectiveness of natural farming inputs can vary with crop, soil and agro-climatic conditions, necessitating location-specific field evaluation.

Cowpea, being a legume, may respond favourably to biologically based nutrient management through improved nutrient cycling and microbial activity. However, comparative evidence on natural-farming practices against recommended inorganic fertilization and nutrient-omission treatments under the conditions of Chhattisgarh remains limited.

Therefore, the present study was undertaken to comparatively evaluate natural farming and inorganic nutrient management practices on the growth and yield of cowpea (*Vigna unguiculata* (L.) Walp.). The study evaluated number of shoots plant⁻¹, number of leaves plant⁻¹, number of pods plant⁻¹ and yield per plot under different natural-farming, inorganic fertilizer, nutrient

omission and control treatments.

Materials and Methods

A field experiment was conducted during the Kharif seasons of 2024–25 and 2025–26 to evaluate natural farming and inorganic nutrient management practices in cowpea (*Vigna unguiculata* (L.) Walp.) cv. Kashi Kanchan, grown in a cowpea–potato–pumpkin cropping sequence. The experiment was laid out in a Randomized Block Design (RBD) comprising 12 treatments and three replications, resulting in 36 plots, with a gross plot size of 4.0 m × 2.4 m. The treatments included T₁: RDF (100% NPK), T₂: RDF (75% NPK) + FYM @ 5 t ha⁻¹, T₃: Ghanjeevamrit @ 1000 kg ha⁻¹ + Jeevamrit through irrigation twice per month, T₄: Ghanjeevamrit @ 1000 kg ha⁻¹ + Jeevamrit through irrigation once per month + farmyard slurry once per month, T₅: Ghanjeevamrit @ 1000 kg ha⁻¹ + Jeevamrit through farmyard slurry twice per month, T₆: Ghanjeevamrit @ 1500 kg ha⁻¹ + Jeevamrit through irrigation twice per month, T₇: Ghanjeevamrit @ 1500 kg ha⁻¹ + Jeevamrit through irrigation once per month + farmyard slurry once per month, T₈: Ghanjeevamrit @ 1500 kg ha⁻¹ + Jeevamrit through farmyard slurry twice per month, T₉: without N fertilizer (PK only), T₁₀: without P fertilizer (NK only), T₁₁: without K fertilizer (NP only), and T₁₂: absolute control (without NPK). In the natural farming treatments, Beejamrit seed treatment, Ghanjeevamrit as basal application, Jeevamrit @ 750 L ha⁻¹ and mulching with preceding-crop residues were maintained as common practices. Observations were recorded at crop maturity for number of shoots plant⁻¹, number of leaves plant⁻¹, number of pods plant⁻¹ and yield per plot (kg). The experimental data for both years were subjected to analysis of variance (ANOVA) under RBD, and treatment means were compared using the critical difference (CD) at 5% significance level. Standard error of mean (SEm ±) and coefficient of variation (CV) were also calculated, and pooled analysis over the two years

was used to assess the overall treatment effects.

Results and Discussion

Number of shoots plant⁻¹ (at maturity)

The pooled data revealed that the effect of nutrient management treatments on the number of shoots plant⁻¹ was non-significant. Numerically, the highest value was recorded under T₁ (RDF 100% NPK; 3.50), followed by T₂ (3.17), whereas the lowest was observed under T₁₂ (absolute control; 1.83). Among natural farming treatments, T₆ recorded 2.94 shoots plant⁻¹. The non-significant response may be attributed to the relatively greater genetic influence on branching compared with short-term differences in nutrient availability. Similar observations regarding the limited response of certain cowpea growth traits to nitrogen management were reported by Danso *et al.* (2025) ^[2].

Table 1: Effect of natural farming and inorganic nutrient management practices on number of shoots plant⁻¹ at maturity of cowpea

Treatments	Number of shoots plant ⁻¹ (at maturity)		
	2024-25	2025-26	Pooled Data
T ₁	3.33	3.67	3.5
T ₂	3	3.33	3.17
T ₃	2.33	2.67	2.5
T ₄	2	2.42	2.21
T ₅	1.83	2.33	2.08
T ₆	2.5	2.67	2.58
T ₇	2.28	2.33	2.31
T ₈	2.17	2.25	2.21
T ₉	1.92	2.17	2.04
T ₁₀	2.83	3.33	3.08
T ₁₁	2.67	3	2.83
T ₁₂	1.67	2	1.83
CD (p=0.05)	NS	NS	NS
CV (%)	-	-	-
Sem(±)	-	-	-

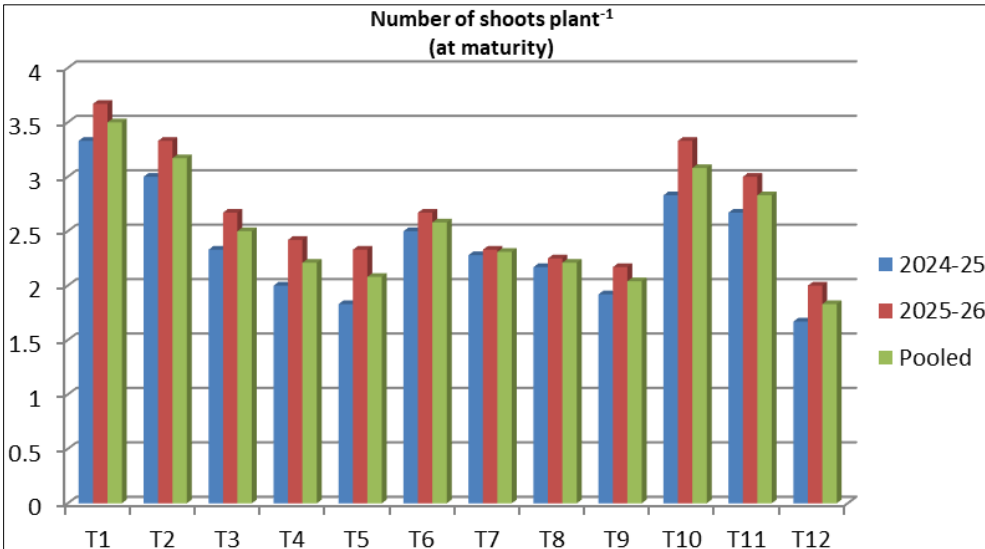


Fig 1: Effect of natural farming and inorganic nutrient management practices on number of shoots plant⁻¹ at maturity of cowpea

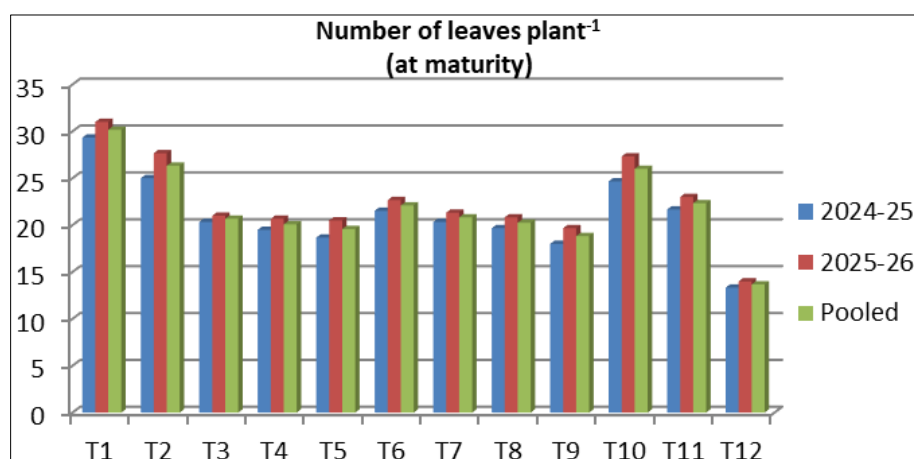
Number of leaves plant⁻¹ (at maturity)

The number of leaves plant⁻¹ was significantly influenced by nutrient management treatments. The pooled maximum was recorded under T₁ (RDF 100% NPK; 30.17), followed by T₂ (26.33), while the minimum was recorded under T₁₂ (13.67). Among natural farming treatments, T₆ recorded the highest number of leaves (22.10), followed by T₇ (20.83) and T₃ (20.67).

The better performance under T₁ may be associated with the prompt availability of N, P and K, while the comparatively better response of T₆ may be related to the higher Ghanjeevamrit dose and frequent Jeevamrit application, which could have supported nutrient mineralization and availability. Similar improvement in cowpea growth with fertilizer application was reported by Abayomi *et al.* (2008) ^[1].

Table 2: Effect of natural farming and inorganic nutrient management practices on number of leaves plant⁻¹ at maturity of cowpea

Treatments	Number of leaves plant ⁻¹ (at maturity)		
	2024-25	2025-26	Pooled Data
T ₁	29.33	31	30.17
T ₂	25	27.67	26.33
T ₃	20.33	21	20.67
T ₄	19.5	20.67	20.08
T ₅	18.67	20.5	19.58
T ₆	21.53	22.67	22.1
T ₇	20.33	21.33	20.83
T ₈	19.67	20.83	20.25
T ₉	18	19.67	18.83
T ₁₀	24.67	27.33	26
T ₁₁	21.67	23	22.33
T ₁₂	13.33	14	13.67
CD (p=0.05)	4.37	5.01	4
CV (%)	12.32	13.2	10.89
Sem(±)	1.49	1.71	1.37

**Fig 2:** Effect of natural farming and inorganic nutrient management practices on number of leaves plant⁻¹ at maturity of cowpea

Number of pods plant⁻¹

The effect of nutrient management treatments on the number of pods plant⁻¹ was non-significant in both years as well as in the pooled analysis. The pooled pod number ranged from 16.08 in T₁₂ to 25.23 in T₁. Among the natural farming treatments, T₆ recorded

the highest numerical value (22.09), followed by T₇ (22.00) and T₃ (21.11). The absence of significant differences may be related to the influence of reproductive-stage factors such as flower-to-pod conversion and pod abortion, which may not respond proportionately to differences in vegetative nutrient supply.

Table 3: Effect of natural farming and inorganic nutrient management practices on number of pods plant⁻¹ of cowpea

Treatments	Number of Pods plant ⁻¹		
	2024-25	2025-26	Pooled Data
T ₁	24.8	25.67	25.23
T ₂	23.07	24.55	23.81
T ₃	20.73	21.48	21.11
T ₄	20.53	20.65	20.59
T ₅	19.47	20.22	19.85
T ₆	21.63	22.55	22.09
T ₇	21.47	22.53	22
T ₈	20.67	21.45	21.06
T ₉	18.47	20.13	19.3
T ₁₀	22.53	23	22.77
T ₁₁	22.27	22.94	22.6
T ₁₂	15.3	16.85	16.08
CD (p=0.05)	NS	NS	NS
CV (%)	-	-	-
Sem(±)	-	-	-

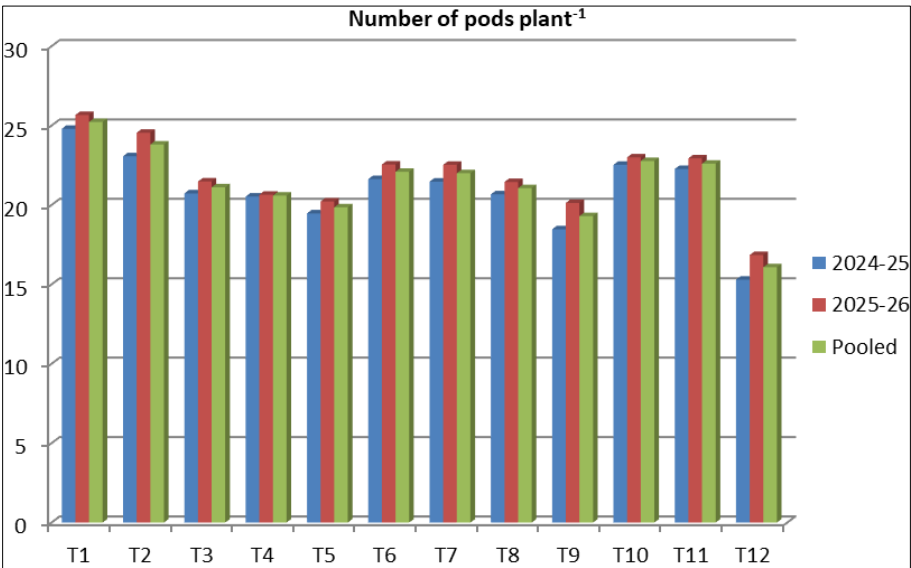


Fig 3: Effect of natural farming and inorganic nutrient management practices on number of pods plant⁻¹ of cowpea

Yield per plot (kg)

Seed yield per plot was significantly influenced by the nutrient management treatments. The pooled maximum yield was obtained under T₁ (RDF 100% NPK; 12.59 kg plot⁻¹), followed by T₂ (10.83 kg plot⁻¹), whereas the minimum yield was recorded under T₁₂ (absolute control; 7.47 kg plot⁻¹). Among the natural farming treatments, T₆ recorded the highest yield (9.14 kg plot⁻¹), followed by T₇ (9.07 kg plot⁻¹) and T₃ (8.92 kg plot⁻¹). The higher yield under T₁ may be attributed to the readily available and balanced supply of N, P and K, which supported vegetative growth and assimilate translocation towards reproductive sinks. The comparatively better performance of T₆ among natural farming treatments may be associated with the higher Ghanjeevamrit dose and frequent Jeevamrit application, promoting a more sustained nutrient supply. Similar yield improvement under integrated nutrient management in cowpea was reported by Dwivedi *et al.* (2023) [3] and Yogananda *et al.* (2019) [7].

Table 4: Effect of natural farming and inorganic nutrient management practices on seed yield per plot (kg) of cowpea

Treatments	Number of Pods plant ⁻¹		
	2024-25	2025-26	Pooled Data
T ₁	24.8	25.67	25.23
T ₂	23.07	24.55	23.81
T ₃	20.73	21.48	21.11
T ₄	20.53	20.65	20.59
T ₅	19.47	20.22	19.85
T ₆	21.63	22.55	22.09
T ₇	21.47	22.53	22
T ₈	20.67	21.45	21.06
T ₉	18.47	20.13	19.3
T ₁₀	22.53	23	22.77
T ₁₁	22.27	22.94	22.6
T ₁₂	15.3	16.85	16.08
CD (p=0.05)	NS	NS	NS
CV (%)	-	-	-
Sem(+)	-	-	-

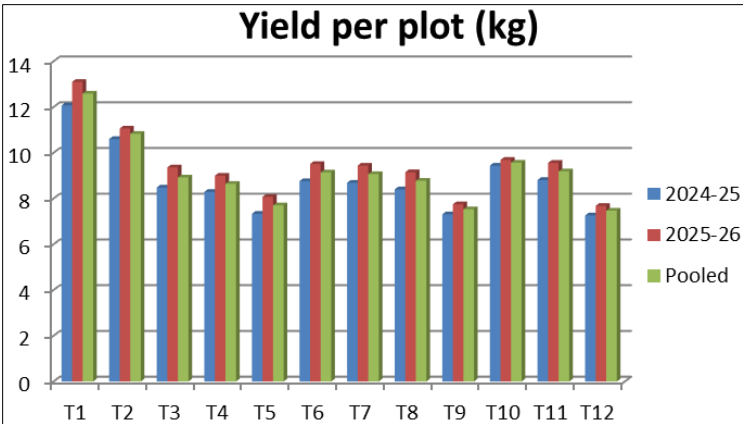


Fig 4: Effect of natural farming and inorganic nutrient management practices on seed yield per plot (kg) of cowpea.

Conclusion

The study demonstrated that nutrient management practices significantly influenced selected growth and yield attributes of cowpea. 100% recommended NPK (T₁) recorded the highest number of leaves plant⁻¹ (30.17) and yield (12.59 kg plot⁻¹), indicating the advantage of balanced and readily available nutrient supply under the prevailing experimental conditions. In contrast, shoot number and pods plant⁻¹ remained statistically

non-significant among treatments. Among the natural farming practices, T₆ (Ghanjeevamrit @ 1500 kg ha⁻¹ + Jeevamrit through irrigation twice a month) showed comparatively better performance, with 22.10 leaves plant⁻¹ and 9.14 kg plot⁻¹ yield. Thus, while inorganic nutrient management provided superior short-term productivity, the better-performing natural farming treatment indicates potential for improving cowpea growth and yield through optimized biological nutrient inputs.

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