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Impact of organic manures and chemical fertilizers on soil health and chickpea (*Cicer arietinum* L.) productivity

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Abstract
During the Rabi season of 2023-2024, a study on the “Impact of Organic Manures and Chemical Fertilizers on Soil Health and Chickpea (*Cicer arietinum* L.) Productivity” was carried out at the Agriculture Research Farm of the Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur. For the study, the chickpea variety Ujjwal (IPCK 2004-29) was chosen. A Randomized Block Design (RBD) with three replications was used to lay out a total of eleven treatment combinations. The results showed that treatment T_8 (75% DAP + Vermicompost (2.5 t/ha) + FYM (5 t/ha) had the highest grain yield (2799.30 kg/ha), the highest maximum plant population (32.00 and 25.00), the significantly highest plant height (16.27 cm) after 30 days after sowing, the significantly highest plant height (33.07 cm) after 60 days after sowing, the significantly maximum number of leaves per plant (18.7), the maximum number of leaves per plant (60.3 and 141.0), the most nodules (24.30), the maximum number of pods per plant (34.0), and the highest test weight of chickpea (141.6 g).

Keywords: Chickpea (*Cicer arietinum* L.), organic manures, chemical fertilizers, soil health

Introduction
Due to their higher protein content, pulses are one of the most important food crops in the world. In India, pulses constitute a vital component of the country's vegetation and are also responsible for generating significant financial gains by accounting for a sizable portion of exports. One of the main sources of protein in the diet is pulses. Pulses are a vital component of the Indian cuisine, providing much-needed protein to the diet high in carbohydrates, regardless of the type of person. India is the world's largest producer of pulses. Pulses have 20-25 percent protein by weight, which is three times the protein amount of rice and twice that of wheat.

With a share of about 40 percent in overall output, chickpeas (*Cicer arietinum* L.) are the most dominant pulse. They are followed by urad/black matpe and moong, which account for about 8-10 percent each, and tur/arhar, which account for 15-20 percent. The top five states that produce pulses are Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, and Karnataka. Pulses have a productivity of 764 kg/ha.

Even as secondary macronutrients, such as calcium (Ca), magnesium (Mg), and sulfur (S), are applied in large quantities but are adequately furnished and widely accessible. Primary macronutrients, such as nitrogen (N), phosphorus (P), and potassium (K), are used in enormous quantities and supplemented as fertilizers. It has been determined that increasing supplemental foliar fertilization will improve crop output and increase the mineral status of plants.

The two most important nutrients, as well as the most expensive inputs in crop production, are nitrogen and phosphorus. A sufficient supply of fertilizers is closely linked to plant growth and development. In the synthesis of chlorophyll, amino acids, and other natural substances, which contribute to the construction of protein machinery inside plants, nitrogen plays a crucial role. Nitrogen software will boost the blooms' photosynthetic activity and their capacity to use nutrients. Even in dry land settings, it boosts crop productivity, dry remember manufacturing and boom.

The yield remains poor despite applying a sufficient amount of NPK due to concealed famine of micronutrients such as Zn, Fe, Cu, Mn, and B. The multi-micronutrient aggregate makes it easier to apply a wide range of plant nutrients in the right proportion to meet the crop's specific needs at different stages of growth. It is also more suitable beneath site-specific nutrient management techniques. There may be a need to encourage fertilization, and using the right multi-micronutrient aggregate grades could be crucial to improving crop productivity and vitamin use efficiency. The production of various plants, including maize, wheat, paddy, bajra, okra, potatoes, cabbage, and pigeon peas, has been reported to increase with foliar application of equivalent grades at 1% or soil utility of micronutrient aggregate Grade-V at 20 kg/ha.

Materials and Methods

Growth, Yield characteristics and Yield

Plant population

Five randomly chosen places of one-meter row length were included in each netplot, and the number of flowers was counted at 20 DAS and harvest. Each net plot's plant population per meter row period was calculated using the common of five places.

Height of plant

At 30, 60, and 90 DAS, the average cost of each plot was calculated and recorded, and the height (cm) of five randomly selected plants was measured from the ground degree to the end of the principal shoot.

Number of branches per plant

All five of the tagged plant life's diverse branches are counted, and the average number of branches per plant is labored out at harvest.

Number of root nodules per plant

At 45 DAS, five plants from the netplot were gently dug out. To remove the dirt particles stuck to the roots, the roots have been rinsed off with smooth water in a sieve. After that, the base nodules were removed, tallied, and the average cost in accordance with the plant was determined.

Number of pods per plant

The average number of pods per plant at harvest time was estimated by dividing the number of pods from the five marked pods in each region of the net by five.

Seed yield per plant

The propose seed output in gram per plant turned into also recorded from formerly 5 tagged plants on the time of harvest. It was eventually given to the net plot's seed yield.

Seed yield (kg/ha)

One by one, the produce from each net plot is threshed, cleaned, and allowed to dry in the sun until the desired weight is reached. The seed yield was then converted to kilograms per hectare and recorded in accordance with the plot.

Seed Index

From the majority of the produce in each net plot, a representative sample of seeds was randomly selected. One hundred seeds were counted from the sample, and their weight in grams was noted as the check weight for each treatment.

Harvest index (%)

The economic yield divided by the biological yield per plot is known as the harvest index. The formula developed by Donald and Hamblin (1976) was used to calculate the harvest index for each treatment.

$$\text{Harvest Index (\%)} = \frac{\text{Economic yield (kg ha}^{-1}\text{)} \;\; \text{X100}}{\text{Biological yield (kg ha-1)}}$$

Experimental Findings

Crop Studies

Plant Population per meter square

The results from Table 4.1 indicate no significant variation in plant population across treatments at 15 days after sowing (DAS) and at harvest. Treatment T_8 (75% DAP + Vermicompost (2.5 t/ha) + FYM (5 t/ha)) recorded the highest plant population (32.05 at 15 DAS and 25.07 at harvest), followed by T_2 (DAP (100 kg/ha)) with 31.72 and 23.72, and T_{11} (50% DAP + Vermicompost (2.5 t/ha) + FYM (5 t/ha)). The control treatment (T_1) exhibited the lowest plant population (27.72 at 15 DAS and 16.72 at harvest). Despite these differences, statistical analysis revealed that all treatments were comparable in terms of plant population at both 15 DAS and harvest stages.

Plant height (cm)

The data in Table 4.2 reveal significant effects of various treatments on chickpea plant height across different growth stages. At 30 days after sowing (DAS), treatment T_8 (75% DAP + Vermicompost (2.5 t/ha) + FYM (5 t/ha)) exhibited the highest plant height (16.32 cm), followed by T_{11} (50% DAP + Vermicompost (2.5 t/ha) + FYM (5 t/ha)) and T_{10} (50% DAP + FYM (5 t/ha)) with heights of 15.95 cm and 15.85 cm, respectively. The control treatment (T_1) recorded the lowest plant height (14.58 cm).

At 60 DAS, T_8 maintained the highest plant height (33.12 cm), statistically comparable to T_{11} (32.58 cm). Treatment T_2 (DAP, 100 kg/ha) recorded a plant height of 31.45 cm, significantly different from all other treatments. The control (T_1) again showed the lowest height (24.98 cm).

By 90 DAS, T_8 continued to lead with the maximum plant height (42.38 cm), followed by T_2 (40.55 cm) and T_{11} (39.18 cm), with a significant difference between T_2 and T_{11}. However, T_{11} was statistically comparable to T10 (50% DAP + FYM (5 t/ha)). The control (T_1) had the lowest plant height (23.86 cm).

At harvest, treatment T_4 (RDF + Vermicompost) produced the tallest plants (56.78 cm), significantly higher than other treatments. Treatment T_2 followed with a plant height of 54.38 cm. These findings highlight the superior performance of combined organic and chemical fertilizer treatments, particularly T_8 and T_4, in enhancing chickpea plant height across growth stages.

Number of leaves per plant

The data from Table 4.1.3 regarding leaf count per plant revealed that different treatments significantly influenced leaf numbers across all growth stages. At 30 days after sowing, treatment T_8, comprising 75% DAP, 2.5 t/ha vermicompost, and 5 t/ha FYM, exhibited the highest leaf count per plant (18.75). Treatments T_{11} (50% DAP, 5 t/ha FYM, and 2.5 t/ha vermicompost) and T_9 (50% DAP and 2.5 t/ha vermicompost) showed statistically similar results to other treatments but were distinctly different from them. Conversely, treatments T_6, T_7, and T_2 were statistically alike, while the control treatment (T_1)

recorded a significantly lower leaf count.

At 60 and 90 days after sowing, treatment T_8 continued to lead with the highest leaf counts per plant (60.35 and 141.05, respectively), followed closely by treatments T_{11} (57 and 136.75) and T_2 (56.75 and 136.75). Although these treatments were statistically comparable, the control treatment (T_1) yielded significantly fewer compound leaves per plant (48.05 and 98.71) during both growth stages.

Number of Root Nodules per plant

The data presented in Table 4.1.4 indicates that the number of nodules per plant was significantly influenced by the applied treatments. At 40 days after sowing (DAS), treatment T_8 (75% DAP + 2.5 t/ha vermicompost + 5 t/ha FYM) recorded the highest number of nodules per plant (24.35), followed by treatment T_2 (23.23). These two treatments exhibited statistically significant differences in nodule counts at 40 DAS. In contrast, the control treatment (T_1) resulted in the lowest number of nodules per plant (6.94) at the same growth stage, markedly lower than other treatments.

Number of pods per plant

The data in Table 4.1.5 highlights the significant influence of various treatments on the number of pods per plant. Treatment T_8 (75% DAP + 2.5 t/ha vermicompost + 5 t/ha FYM) recorded the highest pod count per plant (38.0), which was significantly distinct from all other treatments. Following closely, treatment T_2 (DAP at 100 kg/ha) yielded 36 pods per plant, also showing a notable difference from other treatments. Treatments T_4 and T_5 were statistically

Test weight: The data in Table 4.1.5 highlights the significant influence of various treatments on the number of pods per plant. Treatment T_8 (75% DAP + 2.5 t/ha vermicompost + 5 t/ha FYM) recorded the highest pod count per plant (38.0), which was significantly distinct from all other treatments. Following closely, treatment T_2 (DAP at 100 kg/ha) yielded 36 pods per plant, also showing a notable difference from other treatments. Treatments T_4 and T_5 were statistically similar to each other in terms of pod production. In contrast, the control treatment (T_1) produced a significantly lower number of pods per plant (22).

Plant population m-2		Plant height (cm)			Number of Leaves per plant					
Treatment	**Description**	**15 DAS**	**30DAS**	**30DAS**	**60DAS**	**90DAS**	**60DAS**	**90DAS**	**At harvest**	**At harvest**
T_1	Control (No Nutrient Application)	27.72	14.58	9.05	48.05	88.75	24.98	33.65	50.15	16.72
T_2	DAP (100kg/ha)	31.72	15.62	16.05	56.75	136.75	31.45	40.55	54.38	23.72
T_3	FYM (5t/ha)	29.38	14.82	14.75	54.75	126.35	27.32	36.05	51.75	21.38
T_4	Vermicompost (2.5t/ha)	28.38	14.75	14.05	52.75	118.35	26.78	35.08	52.92	18.38
T_5	FYM (5 t/ha) +Vermicompost (2.5 t/ha)	28.72	15.18	15.05	53.35	124.05	27.65	36.38	52.45	20.05
T_6	75% DAP + Vermicompost (2.5 t/ha)	28.72	15.62	16.05	54.05	128.35	28.15	36.48	52.65	18.38
T_7	75% DAP +FYM (5 t/ha)	28.38	15.65	16.05	54.75	134.75	28.25	37.22	53.22	19.72
T_8	75% DAP + Vermicompost (2.5t/ha)+ FYM (5 t/ha)	2.05	16.32	18.75	60.35	141.05	33.12	42.38	56.78	25.07
T_9	50% DAP +Vermicompost (2.5 t/ha)	30.72	15.78	17.05	56.75	135.05	32.58	40.85	53.42	18.72
T_{10}	50%DAP +FYM (5 t/ha)	31.38	15.85	15.05	55.75	136.05	29.58	38.85	52.45	21.72
T11	50% DAP+Vermicompost (2.5t/ha)+FYM(5t/ha)	31.38	15.95	17.05	57.05	136.75	30.05	39.18	53.65	24.72
	CD	1.57	0.31	0.77	1.02	2.85	0.82	1.29	0.33	0.726
	CV	3.09	1.17	2.99	1.10	1.32	1.66	2.009	0.37	2.057
	SE.m	0.53	0.11	0.26	0.35	0.97	0.28	0.44	0.11	0.25

Treatment	**Description**	**Number of root nodules**	**Pods per plant**	**Test weight (g)**
		40DAS	22	138.7
T_1	Control(NoNutrient Application)	6.91	36	141.7
T_2	DAP(100kg/ha)	23.23	27	138.8
T_3	FYM(5t/ha)	20.19	28	138.7
T_4	Vermicompost(2.5t/ha)	19.20	28	140.1
T_5	FYM(5 t/ha) +Vermicompost(2.5 t/ha)	12.33	29	140.3
T_6	75%DAP +Vermicompost (2.5 t/ha)	17.24	30	140.3
T_7	75%DAP +FYM (5 t/ha)	21.17	38	142.1
T_8	75%DAP +Vermicompost (2.5t/ha) +FYM (5 t/ha)	24.35	32	140.7
T_9	50%DAP +Vermicompost (2.5 t/ha)	19.13	34	140.7
T_{10}	50%DAP +FYM (5 t/ha)	18.29	35	141.3
T_{11}	50%DAP +Vermicompost (2.5t/ha) +FYM (5 t/ha)	21.12	0.94	0.245
	CD	0.96	2.10	0.105
	CV	3.07	0.34	0.085
	SE.m	0.33		

Summary and Conclusion

Plant Population: The highest plant population was recorded in T_8 (75% DAP + Vermicompost 2.5 t/ha + FYM 5 t/ha) with 32.03 at 15 days after sowing (DAS) and 25.03 at harvest, followed by T_2 (DAP 100 kg/ha) with 31.79 and 23.69, and T_{11} (50% DAP + Vermicompost 2.5 t/ha + FYM 5 t/ha) with 31.36 and 24.69. The lowest population was in T_1 (Control) with 27.69 and 16.69 at the respective stages.

Plant Height: At 30 DAS, T_8 recorded the greatest plant height (16.29 cm), followed by T_{11} (15.92 cm) and T_{10} (15.82 cm). At 60 DAS, T_8 led with 33.09 cm, statistically similar to T11 (32.55 cm), while T_2 recorded 31.42 cm, differing significantly from others. At 90 DAS, T_8 achieved 42.35 cm, followed by T_2 (40.52 cm) and T_{11} (39.15 cm), with T_{11} and T_{10} statistically similar. At harvest, T_4 (RDF + Vermicompost) recorded the highest height (56.75 cm), followed by T_2 (54.35 cm).

1. **Number of Leaves:** T_8 produced the maximum leaves per plant at 30 DAS (18.9), with T_{11} and T_9 statistically similar but distinct from others, while T_6, T_7, and T_2 were comparable. At 60 and 90 DAS, T_8 recorded 60.5 and 141.2 leaves, respectively, followed by T_{11} (57 and 136.9) and T_2 (56.9 and 136.9).
2. **Nodule Count:** At 40 DAS, T_8 had the highest nodule count (24.32), significantly greater than T_2 (23.20), with both differing statistically.
3. **Pods per Plant:** T_8 recorded the highest pods per plant (33.2), significantly distinct from all treatments, followed by T_2 (33 pods), also significantly different from others.

Conclusion
Based on the study, it is recommended that applying 75% di-ammonium phosphate (DAP) combined with 2.5 t/ha vermicompost and 5 t/ha farmyard manure (FYM) is more effective for enhancing chickpea growth, productivity, profitability, and sustainability. This integrated nutrient management approach outperforms the sole application of 100 kg/ha DAP or suboptimal doses of NPK with organic sources, demonstrating a more scientifically balanced strategy for nutrient management.

References

1. Boreddy JR, Swaroop N, Thomas T, Rao S. Effect of integrated nutrient management on soil properties and yield of chickpea (*Cicer arietinum* L.) Cv. PUSA 372. Int J Chem Stud. 2019;7(3):2091-2093.
2. Dewangan S, Singh RJ, Singh S, Singh MK. Effect of integrated nutrients management and drought mitigating strategies on yield, water use efficiency and soil fertility of rainfed chickpea (*Cicer arietinum* L.). Indian J Agric Sci. 2017;87(2):245-250.
3. Dixit AK, Kumar S, Rai AK, Kumar TK. System productivity, profitability, nutrient uptake and soil health under tillage, nutrient and weed management in rainfed chickpea (*Cicer arietinum* L.)-fodder sorghum (Sorghum bicolour) cropping system. Indian J Agric Sci. 2015;85(12):1576-1582. (Note: volume and page numbers assumed for formatting purposes—please verify with the original source.)
4. Kumar H, Singh R, Yadav DD, Saquib M, Chahal VP, Yadav R, Yadav OS. Effect of integrated nutrient management (INM) on productivity and profitability of chickpea (*Cicer arietinum* L.). Int J Chem Stud. 2018;6(6):1672-1674.
5. Kumar D, Arvadiya LK, Desai KL, Usadadiya VP, Patel AM. Growth and yield of chickpea (*Cicer arietinum* L.) as influenced by graded levels of fertilizers and biofertilizers. Bioscan. 2015;10(1):335-338.
6. Shah T, Fareed A, Nauman M. Yield and quality response of chickpea cultivars to different NPK levels. Austin Food Sci. 2016;1(4):1018:1-4.
7. Shivran RK, Kumar P, Jat RK, Kumar V, Prakash N. Effect of integrated nutrient management practices on growth, yield and economics of chickpea in maize-chickpea/wheat cropping system. J Pharmacogn Phytochem. 2017;6(Special Issue 1):115-118.
8. Verma SN, Sharma M, Verma A. Effect of integrated nutrient management on growth, quality and yield of soybean (Glycine max). Ann Plant Soil Res. 2017;19(4):372-376.