Plant Archives Vol. 26, Supplement 2, 2026 pp. 220-223 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.supplement-2.026

EVALUATION OF BIO-EFFICACY OF THE TRIPLE SUPER PHOSPHATE FOR CROPPING SYSTEMS IN KALABURAGI LOCATION OVER CONVENTIONAL PHOSPHOROUS SOURCES IN PIGEONPEA

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(Date of Receiving : 16-03-2026; Date of Revision : 24-04-2026; Date of Acceptance : 20-05-2026)

ABSTRACT

A field experiment was conducted at ICAR-KVK, Kalaburagi-I during *Kharif* season 2025 with an objective to study the "Evaluation of Bio-efficacy of the Triple Super Phosphate for cropping systems in Kalaburagi location over conventional Phosphorous sources in Pigeonpea". The soil was clayey in texture and experiment was laid out in randomized block design with three replications and comprised of 12 treatments. Growth parameters at harvest and yield parameters *viz* plant height, number of primary branches and secondary branches and yield parameters *viz* grain yield, stalk yield and husk yield were recorded. Among the treatments, application of recommended nitrogen and phosphorus through triple super phosphate (TSP) along with FYM (10 t ha^{-1}) recorded significantly higher plant height (160.52 cm), primary branches (14.08 plant^{-1}) and secondary branches (21.49 plant^{-1}) also with higher grain yield (1160 kg ha^{-1}), stalk yield (2768 kg ha^{-1}) and husk yield (268 kg ha^{-1}). However, the results for the treatment with recommended N (urea) and P (TSP) recorded plant height (158.24 cm), primary branches (12.71 plant^{-1}) and secondary branches (19.88 plant^{-1}) also with grain yield (1000 kg ha^{-1}), stalk yield (2307 kg ha^{-1}) and husk yield (196 kg ha^{-1}) were statistically found on par with the previous treatment mentioned. The results indicated that integrated nutrient management involving TSP and organic sources enhances growth and yield through improved nutrient availability and uptake.
***Keywords* :** Pigeonpea, TSP, Nutrient management, Growth, Yield.

Introduction

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is an important pulse crop in semi-arid regions of India, contributing significantly to food security and soil fertility. Nutrient management plays a crucial role in improving crop productivity, especially phosphorus, which is often a limiting nutrient in tropical soils. The use of efficient phosphorus sources such as triple super phosphate (TSP) along with integrated nutrient management practices can enhance nutrient availability and crop performance. Growth attributes such as plant height and branching are key determinants of yield, as they influence photosynthetic capacity and assimilate partitioning (Kumar *et al*., 2021). Similarly, yield components such as grain, stalk and husk yield are strongly governed by nutrient availability and uptake efficiency (Rao *et al*., 2022). Recent studies have emphasized the role of integrated nutrient management in improving both growth and yield of legumes (Singh *et al*., 2023; Patel *et al*., 2024).

Hence, the present study was undertaken to evaluate the effect of different nutrient management practices on growth and yield of pigeonpea under Kalaburagi conditions.

Materials and Methods

The experiment was conducted at ICAR-KVK, Kalaburagi-I during *Kharif 2025–26*. The experimental site is located in the North Eastern Dry Zone of Karnataka, with medium deep clay soil. Soil samples were analysed for physical and chemical properties before sowing of the crop. The crop variety used was GRG-811 with spacing of 90 cm × 20 cm.

The experiment consisted of 12 treatments in a randomized complete block design with three replications. The treatments includes: T_1: Control (Nitrogen only, no phosphorous), T_2: Recommended N and P (FP) (Farmer practice), T_3: Recommended N (urea) and P (DAP), T_4: Recommended N (urea) and P (SSP), T_5: Recommended N (urea) and P (TSP), T_6: Recommended N (urea) and P (complex P source NPK 20:20:0), T_7: Recommended N (urea) and P (TSP) with PSB, T_8: Recommended N (urea) and P (TSP) + 10 t ha^{-1} FYM, T_9: Recommended N (urea) and P (TSP) with 5 kg ha^{-1} MAP foliar spray, T_{10}: Recommended N (urea) and P (TSP) with N fixing microbes, T_{11}: No N + Foliar spray of Nano urea + Recommended dose of P fertilizer through TSP and T_{12}: 50% N urea + Foliar spray of Nano urea + Recommended dose of P fertilizer through TSP. The recommended dose of nitrogen (20 kg ha^{-1}) and phosphorus (40 kg ha^{-1}) was applied at the time of sowing.

Growth parameters like plant height, number of primary and secondary branches per plant were recorded at 45, 90, 135 DAS and at harvest. Yield parameters including the Grain yield, stalk yield and husk yield were also recorded.

Statistical analysis of the data was performed using Fisher's method of analysis of variance at a 5% significance level, with critical differences estimated using the t-test and variance technique as given by Panse and Sukhatme (1967).

Results and Discussion

Growth Parameters

Plant Height

Significant differences in plant height were observed among treatments. The treatment receiving recommended N and P through TSP along with FYM (T_8) recorded significant higher plant height (160.52 cm) and the treatment with recommended N (urea) and P (TSP) was found on par with the treatment (158.24 cm). However, the control recorded the lower plant height (129.86 cm). The increase in plant height may be attributed to improved phosphorus availability and enhanced root development, leading to better nutrient uptake. Similar findings were reported by Kumar *et al.* (2021), who observed increased plant height with integrated nutrient management.

Number of Primary Branches

The number of primary branches was significantly higher in recommended N and P through TSP along with FYM (14.08 $plant^{-1}$) which was on par with the treatment recommended N (urea) and P (TSP) (12.71 $plant^{-1}$). Nevertheless, the control recorded lower branches per plant (9.34 $plant^{-1}$). Enhanced branching could be due to improved metabolic activity and nutrient supply. These results corroborate the findings of Singh *et al.* (2023), who reported increased branching with balanced fertilization in legumes.

Number of Secondary Branches

Secondary branches followed a similar trend, with recording the higher (21.49 $plant^{-1}$) in recommended N and P through TSP along with FYM and was also significantly on par with recommended N (urea) and P (TSP) (19.88 $plant^{-1}$). However, significantly lower branches per plant was recorded lower (17.15 $plant^{-1}$) for control. Increased branching is associated with better assimilate production and distribution. Similar findings by Rao *et al.* (2022) also reported that phosphorus fertilization significantly enhances branching in pigeonpea.

Yield Parameters (ref. Table 2 and Fig. 2)

Grain Yield

Grain yield was significantly influenced by nutrient management practices. Significantly higher (1160 kg ha^{-1}) grain yield was recorded in recommended N and P through TSP along with FYM), which was on par with recommended N (urea) and P (TSP) (1000 kg ha^{-1}). Nevertheless, the control recorded the lower (710 kg ha^{-1}) grain yield. Improved grain yield could be attributed to enhanced growth parameters and efficient translocation of assimilates. Similar trends were reported by Patel *et al.* (2024), indicating higher yields with integrated nutrient application.

Stalk Yield

Stalk yield was significantly higher (2768 kg ha^{-1}) in recommended N and P through TSP along with FYM) and was found on par with recommended N (urea) and P (TSP) (2307 kg ha^{-1}). However, lower (1555 kg ha^{-1}) stalk yield was recorded in control. Increased biomass production is directly linked to improved nutrient uptake and vegetative growth. These findings align with Sharma *et al.* (2022), who reported higher biomass under integrated nutrient management.

Husk Yield

Husk yield followed a similar pattern, with recommended N and P through TSP along with FYM) recording the higher (268 kg ha^{-1}) and was found on par with recommended N (urea) and P (TSP) (196 kg ha^{-1}). The control recorded lower (112 kg ha^{-1}) husk yield. Higher husk yield indicates better overall productivity and dry matter accumulation, as also observed by Verma *et al*. (2021).

Table 1: Growth parameters of pigeonpea at harvest as influenced by nutrient management

Treatments	Plant height (cm)	No. of 1° branches (plant^{-1})	No. of 2° branches (plant^{-1})
T$_1$: Control (Nitrogen only, no phosphorous)	129.86	9.34	17.15
T$_2$: Recommended N and P (FP) (Farmer practice)	143.12	10.78	17.61
T$_3$: Recommended N (urea) and P (DAP)	158.71	13.01	20.18
T$_4$: Recommended N (urea) and P (SSP)	157.82	12.10	19.08
T$_5$: Recommended N (urea) and P (TSP)	158.24	12.71	19.88
T$_6$: Recommended N (urea) and P (complex P source NPK 20:20:0)	158.02	12.34	19.47
T$_7$: Recommended N (urea) and P (TSP) with PSB	159.10	13.11	20.63
T$_8$: Recommended N (urea) and P (TSP) + 10 t/ha FYM	160.52	14.08	21.49
T$_9$: Recommended N (urea) and P (TSP) with 5 kg/ha MAP foliar spray	160.29	13.93	21.18
T$_{10}$: Recommended N (urea) and P (TSP) with N fixing microbes	159.70	13.46	21.00
T$_{11}$: No N + Foliar spray of Nano urea + Recommended dose of P fertilizer through TSP	156.42	11.65	18.23
T$_{12}$: 50% N urea + Foliar spray of Nano urea + Recommended dose of P fertilizer through TSP	157.06	11.94	18.88
S.Em.±	**2.05**	**0.86**	**1.14**
C.D. (P=0.05)	**6.03**	**2.51**	**3.35**

Table 2: Grain, stalk and husk yield of pigeonpea as influenced by nutrient management

Treatments	Grain yield (kg ha^{-1})	Stalk yield (kg ha^{-1})	Husk yield (kg ha^{-1})
T$_1$: Control (Nitrogen only, no phosphorous)	710	1555	112
T$_2$: Recommended N and P (FP) (Farmer practice)	860	2030	126
T$_3$: Recommended N (urea) and P (DAP)	1026	2499	205
T$_4$: Recommended N (urea) and P (SSP)	953	2146	151
T$_5$: Recommended N (urea) and P (TSP)	1000	2307	196
T$_6$: Recommended N (urea) and P (complex P source NPK 20:20:0)	962	2281	173
T$_7$: Recommended N (urea) and P (TSP) with PSB	1074	2593	227
T$_8$: Recommended N (urea) and P (TSP) + 10 t/ha FYM	1160	2768	268
T$_9$: Recommended N (urea) and P (TSP) with 5 kg/ha MAP foliar spray	1136	2615	266
T$_{10}$: Recommended N (urea) and P (TSP) with N fixing microbes	1077	2610	264
T$_{11}$: No N + Foliar spray of Nano urea + Recommended dose of P fertilizer through TSP	914	2093	131
T$_{12}$: 50% N urea + Foliar spray of Nano urea + Recommended dose of P fertilizer through TSP	929	2104	146
S.Em.±	**85**	**228**	**44**
C.D. (P=0.05)	**248**	**670**	**130**

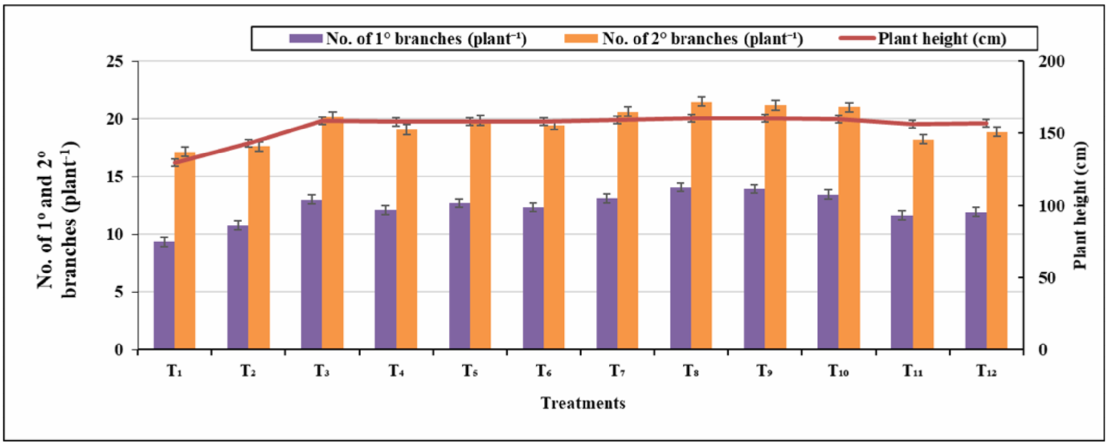

Fig. 1: Growth parameters of pigeonpea at harvest as influenced by nutrient management

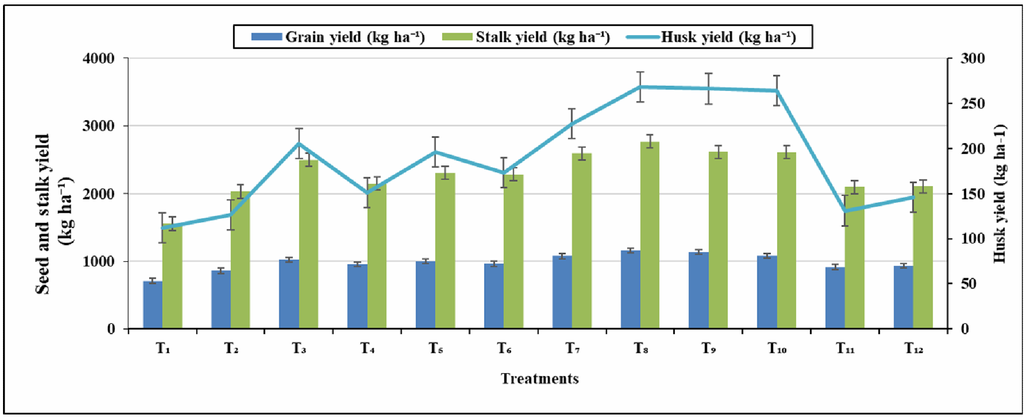

Fig. 2: Grain, stalk and husk yield of pigeonpea as influenced by nutrient management

Conclusion

The study revealed that integrated nutrient management significantly influenced growth and yield of pigeonpea. Application of recommended nitrogen and phosphorus through TSP along with FYM resulted in superior growth attributes and higher grain, stalk and husk yields. However, statistically similar results were also recorded for recommended N (urea) and P (TSP) indicating an alternative phosphorous source for better soil health and reduce the dependency on conventional source of phosphorus. Hence, the combined use of TSP can be recommended for enhancing productivity of pigeonpea under similar agro-climatic conditions.

Acknowledgement

This research was a part of joint collaboration between OCP, ISAP and ICAR-KVK, Kalaburagi-I and the author greatly appreciate research facilities and support provided from the KVK, for conducting this research study. The author is grateful to members of the research committee, Dr. Yusufali Nimbargi, Scientist (Agronomy), ICAR-KVK, Kalaburagi-I, Dr. Raju G Teggelli, Senior Scientist and Head, ICAR-KVK, Kalaburagi-I, Dr. Pandit S Rathod, Professor and Head, Department of Agronomy, CoA, Kalaburagi, Dr. Zaheer Ahmed, Scientist (Plant Pathology), ICAR-KVK, Kalaburagi-I and Dr, B.V. Shreenivas, Scientist (Soil Science), ICAR-KVK, Kalaburagi-I, for their engrossing guidance, incessant encouragement, constructive suggestions propitious assistance, keen and sustained interest, kind and gracious patronage during the entire course of investigation and preparation of this manuscript.

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