

EFFECT OF PHOSPHORUS LEVELS ON YIELD AND QUALITY OF FODDER COWPEA VARIETIES UNDER RAINFED CONDITIONS

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ABSTRACT

The experiment was conducted during *kharif*, 2018-19 on red loam soils of Regional Agricultural Research Station, Tirupati. The experiment was laid in the randomized block design with factorial concept and each treatment replicated thrice. The results showed that the higher green fodder yield (21,054 kg ha⁻¹) and dry fodder yield (3,473 kg ha⁻¹) was obtained with MFC 08-14 variety. Significantly higher crude protein content (12.15%) was registered with APFC 10-1 variety, while the difference in crude fibre content among the varieties were found non-significant. Among the different levels of phosphorus, application of 60 kg P₂O₅/ha recorded significantly higher green fodder yield (21,590 kg/ha). Crude fibre content was not significantly influenced either by varieties or different levels of phosphorus application under rainfed conditions of Southern Zone of Andhra Pradesh.

Key Words:Crude protein,Fodder cowpea,Green fodder yield,Phosphorus, Rainfed.

INTRODUCTION

Fodder production plays a pivotal role in supporting the livestock sector, particularly in regions where mixed farming systems are practiced. Fodder cowpea (*Vigna unguiculata* L. Walp) is a versatile leguminous crop widely cultivated for its high biomass yield, excellent nutritional profile and soil-enriching properties. Its dual-purpose nature, providing both grain and green fodder, makes it an indispensable component of sustainable farming systems, especially in resource-constrained and rainfed regions. Particularly under rainfed conditions, it serves as a critical forage resource for livestock due to its drought tolerance and rapid growth. However, the productivity and nutritional

quality of cowpea fodder are largely influenced by varietal selection and nutrient management practices, particularly phosphorus (P) nutrition. Phosphorus plays a crucial role in several physiological and biochemical processes, root development, energy transfer and overall plant vigor, synthesis of nucleic acids, proteins and directly influencing biomass accumulation and forage quality (Boakye and Wilson, 2019). Furthermore, the response to phosphorus application may vary across different cowpea varieties, owing to their genetic makeup and adaptability (Ahmad *et al.*, 2017). Hence, understanding the interaction between phosphorus levels and varietal performance is essential to develop location-specific

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phosphorus needs strategies and to identify high-yielding, quality fodder cowpea genotypes suited to low-input rainfed systems. Hence, the present investigation was taken up with an objective to identify the best cowpea fodder variety and optimum dose of phosphorus for higher fodder yield and quality for Southern Zone of Andhra Pradesh.

MATERIAL AND METHODS

A field experiment was conducted during the *kharif* season of 2018–19 at Regional Agricultural Research Station, Tirupati of Acharya N.G. Ranga Agricultural University. The experimental site is geographically situated at 13.5°N latitude and 79.5°E longitude, with an altitude of 182.9 m, which falls under the Southern Agro-Climatic Zone of Andhra Pradesh. The region experiences a tropical climate with erratic rainfall typical of rainfed conditions. The soil type of the experimental plot was red loamy, with a neutral pH and good drainage. Prior to the initiation of the experiment, a composite soil sample was collected and analyzed for its initial fertility status, revealing available nutrient contents of 173 kg N/ha, 25 kg P₂O₅/ha, and 234 kg K₂O/ha. The experiment was laid out in a Factorial Randomized Block Design (FRBD) with three replications. The experiment consisted of two factors and factor one consists of four fodder cowpea varieties (V1: MFC 08-14, V2: Co-8, V3: APFC10-1 and V4: EC-4216) and factor two consist of four Phosphorus levels (P1: Control, P2: 40, P3: 60 and P4: 80 kg P₂O₅/ha). A total of 16 treatment combinations (4 varieties × 4 phosphorus levels). Each treatment was randomly allotted within each replication to minimize experimental error. Line sowing of cowpea varieties was done at a recommended spacing of 30 x 10 cm. Phosphorus was applied in the form of single super phosphate (SSP) as per the treatment levels as a basal dose at the time of sowing. A uniform dose of nitrogen and potassium, as per standard agronomic

recommendations, was applied to all plots to eliminate their variability. Other intercultural operations such as weeding, irrigation (if necessary), pest and disease management were carried out uniformly across all plots following recommended practices to ensure optimal crop growth. At maturity, data were collected on yield and quality parameters from the net plot area, excluding border rows to avoid edge effects. Samples for quality analysis were dried and ground for chemical estimation. Crude protein content was estimated using standard procedures, such as the Kjeldahl method. Crude fibre content in whole plant was estimated by acid-alkali digestion method and was expressed in percentage. The collected data were subjected to analysis of variance (ANOVA) as per the FRBD design. Treatment means were compared using the Least Significant Difference (LSD) test at a 5% level of significance to determine the effect of phosphorus levels and variety on growth and yield attributes.

RESULTS AND DISCUSSION

Data pertaining to growth, yield and quality parameters of fodder cowpea varieties influenced by phosphorous levels were presented in Table no.1.

Growth Parameters

Plant height at 30 days after sowing (DAS) and at harvest did not significantly vary among the varieties. EC-4216 (V4) recorded the highest plant height at 30 DAS (18.0 cm) and at harvest (111.1 cm) while lower plant height was noticed with MFC 08-14 (Table 1). However, all the varieties were statistically non-significant. Among phosphorus levels, all the levels of phosphorus application showed a significant effect on plant height over control both at 30 DAS and at harvest. Maximum plant height at 30 DAS was recorded with 40 kg/ha of P₂O₅ (18.2 cm), while the tallest plants at harvest were noted under 80 kg/ha of P₂O₅

Table 1. Growth, yield and quality parameters of fodder cowpea varieties at varied phosphorus levels.

Treatment	Plant height at 30 DAS (cm)	Plant height at harvest (cm)	Green fodder yield (kg/ha)	Dry fodder yield (kg/ha)	Crude protein (%)	Crude fibre (%)
Varieties						
V1: MFC 08-14	17.7	104.0	21054	3473	11.89	52.43
V2: Co-8	17.0	106.6	20834	3464	11.51	53.05
V3: APFC10-1	17.6	107.9	21009	3412	12.15	52.21
V4: EC-4216	18.0	111.1	21011	3454	12.04	53.19
CD (0.05)	NS	NS	NS	NS	0.47	NS
P₂O₅ Levels (kg/ha)						
P ₁ : Control	16.8	99.5	19981	3222	12.09	51.93
P ₂ : 40		18.2	106.4	21371	3579	12.54
51.80						
P ₃ : 60		17.7	111.6	21590	3458	12.49
52.12						
P ₄ : 80		17.6	112.4	20964	3545	12.25
51.94						
C.D (P=0.05)	0.8	8.3	835	NS	NS	NS

(112.4 cm) followed by 60 kg/ha (111.6 cm) and 40 kg/ha of P₂O₅ (106.4 cm) which inturn comparable with one another. Significantly lower plant height was observed with control (99.5 cm). These results suggest a positive influence of phosphorus on vegetative growth (Bhagat *et al.*, 2018, Anjeela *et al.*, 2021 and Gangadhar *et al.*, 2023).

Yield Parameters

With refer to green fodder yield, non-significant response was observed among the fodder cowpea varieties tested. Among graded levels of phosphorus application, green fodder yield increased with increasing levels of phosphorus application up to 60 kg P₂O₅/ha, which recorded the highest yield of 21,590 kg/

ha, followed closely by 40 kg P₂O₅/ha. However, a further increase to 80 kg P₂O₅/ha resulted in a slight decline in yield (20,964 kg/ha), possibly due to secondary impact of extremely high levels or existing micronutrient deficiencies, not a direct reduction of green fodder yield across all varieties at typically studied high levels (Table 1). With respect to the dry fodder yield, the differences among the varieties were non-significant. Among the different levels of phosphorus tried, higher dry matter yield (3579 kg/ha) was recorded at 40 kg P₂O₅/ha, suggesting upper limit for maximizing biomass production. However, dry matter yield differences across phosphorus levels were not statistically significant, suggesting that phosphorus application mainly enhanced fresh

biomass rather than dry matter accumulation (Rakeshet *al.*, 2016, Bhagat *et al.*, 2018, Neerajet *al.*, 2022, Biraj *et al.*, 2024, and Dula *et al.*, 2024).

Quality Parameters

With respect to quality parameters, crude protein content was significantly influenced by varieties. The variety APFC10-1 recorded the highest crude protein content (12.15%), which was on par with EC-4216 (12.04%) (Table 1) while, Co-8 had the lowest protein content (11.51%). Among the phosphorus levels, crude protein content was highest at 40 kg P₂O₅/ha (12.54%), while non application of phosphorus resulted in the lowest crude protein (12.09%). Crude fibre content did not differ significantly among the varieties, although values ranged between 52.21% (APFC10-1) and 53.19% (EC-4216). This suggests that while all varieties produced comparable yields, APFC10-1 stands out for nutritional quality, and EC-4216 for overall biomass and height. There was no significant difference in crude fibre content. These results indicate that 40–60 kg P₂O₅/ha is optimum for both yield and quality of fodder cowpea, while further increase to 80 kg offers no additional benefit. These results are collaborated with Velayudham *et al.*, 2015.

CONCLUSION

Among the fodder cowpea varieties tested, MFC 08-14 and EC- 4216 performed well in terms of green and dry fodder yield, while APFC10-1 had shown higher crude protein content. Phosphorus application, particularly at 60 kg/ha, significantly improved green fodder yield, making it a beneficial practice for enhancing fodder productivity under rainfed conditions of Southern Zone of Andhra Pradesh.

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