

# Effect of organic nutrient management on quality parameters and yield of fodder cowpea varieties

## ABSTRACT

The field experiment was conducted during Rabi season of, 2022–2023 on sandy clay loam soils at a dry land farm in the S.V. Agricultural College in Tirupati, Andhra Pradesh, India. To study the Effect of organic nutrient management on quality parameters and yield of fodder cowpea The Split-plot design of the study included three replications. The treatments consisted of four varieties viz., V<sub>1</sub>: Vijaya, V<sub>2</sub>: MFC-09-01, V<sub>3</sub>: MFC-09-03, and V<sub>4</sub>: MFC-08-14 assigned to main plots, four organic nutrient management practices viz., F<sub>1</sub>: Control, F<sub>2</sub>: 100 % organic source through (FYM) F<sub>3</sub>: 75 % organic source through (FYM) + *Rhizobium* + PSB + KSB and F<sub>4</sub>: 50 % organic source through (FYM) + *Rhizobium* + PSB + KSB allotted to sub plots. The soil was neutral in reaction (6.8 pH) low in available nitrogen (176 kg ha<sup>-1</sup>) and medium in available phosphorus (27 kg ha<sup>-1</sup>) and low in available potassium (219 kg ha<sup>-1</sup>) status. The results revealed that among the varieties tested, higher quality parameters i.e., (Crude protein content, Total ash content and dry fodder yield) was recorded with MFC-09-01 (V<sub>2</sub>) and dry fodder yield (5.8 t ha<sup>-1</sup>) as well as crude protein (15.1 %), ash content (12.5 %) were obtained with the application of 75 % organic source through (FYM) + *Rhizobium* + PSB + KSB. Furthermore, compared to all other treatments.

**Keywords:** Biofertilizers, fodder cowpea, FYM, quality parameters, dry fodder yield, Sandy clay loam soils, quality parameters.

## 1. INTRODUCTION

India's livestock production is vital to the country's agricultural sector and considerably boosts GDP. Green fodder and dry fodder availability are currently deficient by 35.6 percent and 10.95 percent, respectively [1]. Looking ahead to 2050, the IGFR Vision 2050 study projects a demand for 1012 million tonnes of green fodder and 631 million tonnes of dry fodder. However, the lack of fodder and its poor quality provide problems for the livestock industry. The gap between the dry and green feed supply is typically 40%; by 2025, this disparity can increase to 45%. To fulfil the vast animal population in India's high fodder demand, there is a need to boost forage crop output and productivity while maintaining soil health and environmental sustainability [2].

When compared to European nations, the production and use of fodder in India paints a very different picture. The country's current fodder resources can only supply between 45 and 50 per cent of the demand, and the severity of the fodder shortage varies from state to state. The situation is made worse by the expanding livestock industry, particularly that of genetically modified animals and this is the scenario of fodder production in India.

Leguminous cowpea (*Vigna unguiculata*) is a popular tropical fodder crop. Because of its rapid growth, it can be grown during the warm and wet seasons. It may be raised on an annual basis. It is raised for green-form feeding, hay production, or ensiling in combinations with sorghum or maize. Cowpea contains 20 per cent crude fibre and 16 per cent crude protein.

Organic nutrient sources give major emphasis on recovery and maintenance of soil fertility and for sustainable yield. Organic systems rely on the management of organic matter to enhance the soil fertility and productivity (Naik et al., 2014). Organic matter has an overwhelming effect on almost all soil properties. A best organic nutrient source not only provides organic matter but also adds essential minerals to the soil. Organic manure when incorporated in the soil has positive effects on plant growth, yield and soil physiochemical properties (Huan et al., 2007). Biofertilisers help in fixing atmospheric nitrogen and mobilizing fixed macro- and micronutrients in the soil into plant-available forms. Organic farming plays a critical role in preserving long-term soil fertility and sustainability.

Keeping the above facts in view the present study was planned to investigate the effect of applying organic nutrient management FYM, *Rhizobium*, PSB and KSB in combination on the performance of fodder cowpea varieties under field conditions.

## 2. MATERIAL AND METHODS

The present investigation entitled "Effect of organic nutrient management on quality parameters and yield of fodder cowpea varieties" was conducted during *rabi*, 2022-23 in dryland farm of S.V. Agricultural College, ANGRAU, Tirupati, which is geographically situated at 13°56'56.4"N latitude and 79°67'68.4"E longitude, with an altitude of 182.9 m above the mean sea level. The soil was neutral in reaction (6.8 pH) low in available nitrogen (176 kg ha<sup>-1</sup>) and medium in available phosphorus (27 kg ha<sup>-1</sup>) and low in available potassium (219 kg ha<sup>-1</sup>) status. The experiment was done using a The Split-plot design of the study included three replications. The treatments consisted of four varieties viz., V<sub>1</sub>: Vijaya, V<sub>2</sub>: MFC-09-01, V<sub>3</sub>: MFC-09-03, and V<sub>4</sub>: MFC-08-14 assigned to main plots, four organic nutrient management practices viz., F<sub>1</sub>: Control, F<sub>2</sub>: 100 % organic source through (FYM) F<sub>3</sub>: 75 % organic source through (FYM) + *Rhizobium* + PSB + KSB and F<sub>4</sub>: 50 % organic source through (FYM) + *Rhizobium* + PSB + KSB allotted to sub plots). The crop was sown with a seed rate of 40 kg ha<sup>-1</sup> at a spacing of 30 × 10 cm. Soil application of biofertilizers was done by mixing 1.25 l ha<sup>-1</sup> of each bio inoculant in 500 kg of well-decomposed FYM and applied as basal dose (applied 24 hrs before sowing). Seed treatment of biofertilizers was done by mixing 10 ml of each bio inoculant with 1 kg of seed and drying for 10-15 minutes under shade before sowing. Irrigation and weeding were done as and when required. At 50% flowering, harvesting was completed. The data on various parameters were statistically analysed using the split-plot design method recommended by Panse and Sukhatme [6].

### 2.1 Quality parameters

**Crude protein:** Total nitrogen content of plant samples was estimated by modified Micro kjeldhal method [7] and the crude protein content was estimated by using the following formula which was expressed in percentages.

$$\text{Crude protein (\%)} = \text{N (\%)} \times 6.25$$

**Crude fibre:** Crude fibre content in whole plant was estimated by acid-alkali digestion method and was expressed in percentage.

$$\text{Crude Fibre (\%)} = \frac{\text{Weight before ashing} - \text{weight after ashing}}{\text{Weight of the sample taken}} \times 100$$

**Total Ash content :** Ash is the inorganic component of the sample left after complete ignition of the sample at 600° C in muffle furnace. Ash content was calculated by using the following formula and expressed in percentage

$$\text{Total Ash content (\%)} = \frac{\text{Weight of ash a}}{\text{Weight of oven dry sample}} \times 100$$

### 2.2 Yield parameter

**Dry fodder yield:** After harvesting of fodder cowpea from net plot area, plants were left in the field for a period of one week for sun drying. Then dry fodder yield of cowpea was weighed in net plot area and total dry fodder yield was expressed in t ha<sup>-1</sup>.

## 3. RESULTS AND DISCUSSION

Data pertaining to Quality parameters and productivity at harvest, as influenced by application of organic nutrient management in fodder cowpea varieties were presented in Table and discussed in different sections.

### 3.1 Quality parameters

#### Crude protein content

Crude protein content, was higher with the variety MFC-09-01 ( $V_2$ ), which was followed by MFC-08-14 ( $V_4$ ), which was however comparable with Vijaya ( $V_1$ ). The difference in quality parameters and dry fodder yield among the varieties might be due to its genetic potential of having profuse vegetative growth and dry matter accumulation which ultimately led to higher nutrient uptake especially nitrogen, an essential component of protein which might have resulted in more crude protein content in that variety (Iqbal *et al.* (1998). Among the various organic nutrient management practices tried, higher crude protein was higher with application of 75 % N through organic source (FYM) + *Rhizobium* + PSB + KSB ( $F_3$ ). The higher protein content in cowpea was mainly due to stimulatory effect of organic manure on efficiency of soil microbes and mitigates micronutrient deficiency besides supply of major nutrients and improving the physico-chemical properties of soil. These results consistent with findings of Meena *et al.* (2012), Ramet *et al.* (2018)

#### Crude fibre

Crude fibre content was higher with the variety MFC-09-03 ( $V_3$ ) followed by Vijaya ( $V_1$ ) which was however, comparable with the variety MFC-08-14 ( $V_4$ ) whereas the lower fibre content was recorded with the variety MFC-09-01 ( $V_2$ ). Fodders containing low crude fibre content are an indication of more palatability by animals and they contain digestible nutrients. These similar findings observed by Kalra and Sharma (2015), and Sapta *et al.* (2015).

#### Total ash content

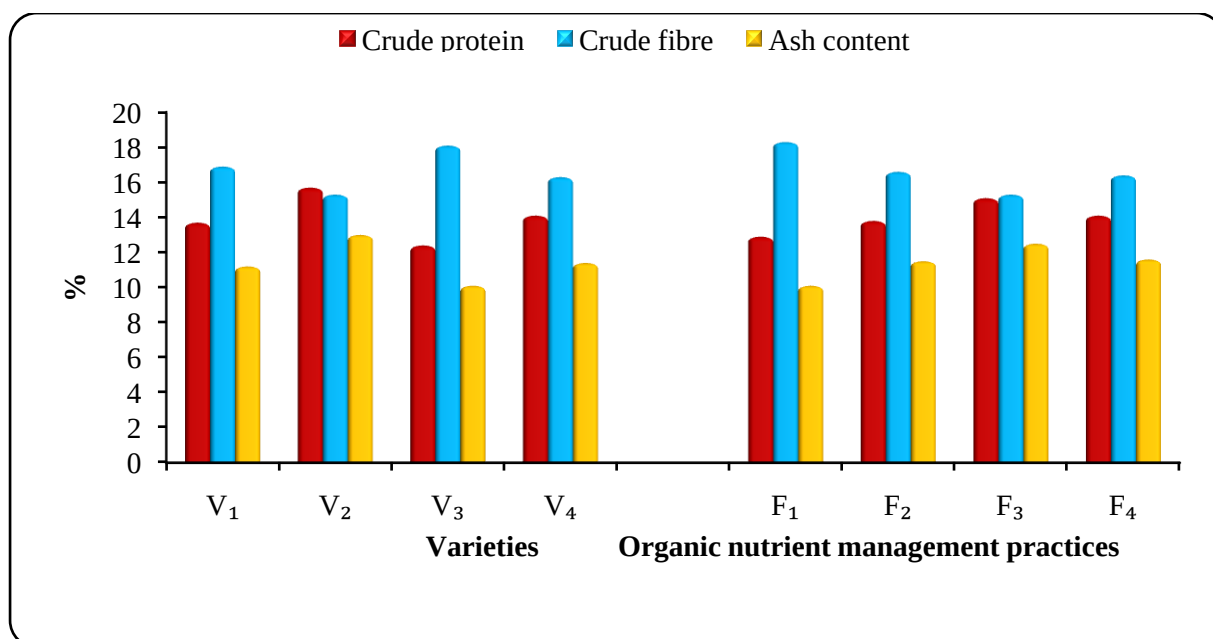
Total ash content, was higher with the variety MFC-09-01 ( $V_2$ ), which was followed by MFC-08-14 ( $V_4$ ), which was however comparable with Vijaya ( $V_1$ ). The difference in quality parameters and dry fodder yield among the varieties might be due to its genetic potential of having profuse vegetative growth and dry matter accumulation which ultimately led to higher nutrient uptake especially nitrogen, an essential component of protein which might have resulted in more crude protein content in that variety (Iqbal *et al.* (1998). Among the various organic nutrient management practices tried, higher crude protein was higher with application of 75 % N through organic source (FYM) + *Rhizobium* + PSB + KSB ( $F_3$ ). The higher protein content in cowpea was mainly due to stimulatory effect of organic manure on efficiency of soil microbes and mitigates micronutrient deficiency besides supply of major nutrients and improving the physico-chemical properties of soil. These results consistent with findings of Meena *et al.* (2012), Roy *et al.* (2015) and Sharma *et al.* (2016).

### 3.2 Dry fodder yield

Dry fodder, was higher with the variety MFC-09-01 ( $V_2$ ), which was followed by MFC-08-14 ( $V_4$ ), which was however comparable with Vijaya ( $V_1$ ). The difference in quality parameters and dry fodder yield among the varieties might be due to its genetic potential of having profuse vegetative growth and dry matter accumulation which ultimately led to higher nutrient uptake especially nitrogen, an essential component of protein which might have resulted in more crude protein content in that variety (Iqbal *et al.* (1998). Among the various organic nutrient management practices tried, dry fodder yield, ( $\text{tha}^{-1}$ ) was higher with application of 75 % N through organic source (FYM) + *Rhizobium* + PSB + KSB ( $F_3$ ), which was followed by 50% N through organic source + *Rhizobium* + PSB + KSB ( $F_4$ ) which was at par with 100 % N through organic source (FYM) ( $F_2$ ), whereas shorter plants were noticed in control ( $F_1$ ). FYM could be attributed to the stimulated activities of microorganisms and synchronized release of nitrogen, which might have stimulated the cellular activity, useful for the process of cell division. The results are in close conformity with the findings of Zalate *et al.* (2009), Verma and Munshi (2003).

Table 1 Quality parameters and Yield of fodder cowpea as influenced by varieties and organic nutrient management practices

| Treatments                                                                         | Crude protein content<br>% | Crude fibre<br>content<br>% | Ash content<br>% | Dry fodder yield<br>(t ha <sup>-1</sup> ) |
|------------------------------------------------------------------------------------|----------------------------|-----------------------------|------------------|-------------------------------------------|
| <b>Varieties(V)</b>                                                                |                            |                             |                  |                                           |
| V <sub>1</sub> : Vijaya                                                            | 13.7                       | 16.9                        | 11.2             | 4.9                                       |
| V <sub>2</sub> : MFC-09-01                                                         | 15.7                       | 15.3                        | 13.0             | 5.3                                       |
| V <sub>3</sub> : MFC-09-03                                                         | 12.4                       | 18.1                        | 10.1             | 3.8                                       |
| V <sub>4</sub> : MFC-08-14                                                         | 14.1                       | 16.3                        | 11.4             | 5.1                                       |
| SEm±                                                                               | 0.44                       | 0.61                        | 0.25             | 0.178                                     |
| CD(P=0.05)                                                                         | 1.3                        | 1.7                         | 0.7              | 0.52                                      |
| <b>Organic nutrient management practices (F)</b>                                   |                            |                             |                  |                                           |
| F <sub>1</sub> : Control                                                           | 12.9                       | 18.3                        | 10.1             | 3.6                                       |
| F <sub>2</sub> : 100 %N through FYM                                                | 13.8                       | 16.6                        | 11.5             | 4.8                                       |
| F <sub>3</sub> : 75 % N through organic source(FYM) + <i>Rhizobium</i> + PSB +KSB  | 15.1                       | 15.3                        | 12.5             | 5.8                                       |
| F <sub>4</sub> : 50% N through organic source (FYM) + <i>Rhizobium</i> + PSB + KSB | 14.1                       | 16.4                        | 11.6             | 4.9                                       |
| SEm±                                                                               | 0.42                       | 0.46                        | 0.31             | 0.291                                     |
| CD (P=0.05)                                                                        | 1.2                        | 1.3                         | 0.9              | 0.85                                      |
| <b>Varieties (V) x Organic nutrient managementpractices (F)</b>                    |                            |                             |                  |                                           |
| <b>V at F</b>                                                                      |                            |                             |                  |                                           |
| SEm±                                                                               | 0.848                      | 0.924                       | 0.620            | 0.528                                     |
| CD(P=0.05)                                                                         | NS                         | NS                          | NS               | NS                                        |
| <b>F at V</b>                                                                      |                            |                             |                  |                                           |
| SEm±                                                                               | 0.824                      | 0.953                       | 0.577            | 0.526                                     |
| CD(P=0.05)                                                                         | NS                         | NS                          | NS               | NS                                        |



**Fig. 1. Quality parameters of fodder cowpea as influenced by varieties and organic nutrient management practices**

#### 4. CONCLUSION

In conclusion the study revealed that cultivation of genotype MFC-09-01 with 75 % of N through FYM + *Rhizobium* + PSB + KSB enhanced the yield, quality and economic returns of fodder cowpea in Southern Agro Climatic zone of A.P during *rabi*

#### COMPETING INTERESTS

Author has declared that no competing interests exist.

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