Plant Archives Vol. 25, Supplement 1, 2025 pp. 1407-1411 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.supplement-1.192

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND QUALITY OF FODDER COWPEA (*VIGNA UNGUICULATA* L.)

Sruthi G.[1*], Balazzii Naaiik R. V. T.[2], Bhanu Rekha K.[3], Sukruth Kumar T.[4] and Triveni S.[5]
[1]Department of Agronomy, College of Agriculture, P.J.T.S.A.U., Hyderabad, Telangana, India
[2]Department of Agronomy, AICRP on Forage crops and utilization, Rajendranagar, Hyderabad, Telangana, India
[3]Department of Agronomy, Agriculture College, Adilabad, Telangana, India–504 002
[4]Department of SSAC, AICRP on Micronutrients, ISHM, A.R.I., Rajendranagar, Hyderabad, Telangana, India
[5]Department of Microbiology & Bio Energy, College of Agriculture, P.J.T.S.A.U., Hyderabad- 500 030, Telangana, India
*Corresponding author E-mail: gandamallasruthi0@gmail.com
(Date of Receiving : 12-09-2024; Date of Acceptance : 01-11-2024)

ABSTRACT

A field experiment was conducted during *kharif,* 2023 to evaluate the "Effect of integrated nutrient management on growth and quality of fodder cowpea (*Vigna unguiculata*) at AICRP on Forage Crops and Utilization Field, ARI, Rajendranagar, Hyderabad. The experiment was laid out in Randomized Block Design with ten treatments and replicated thrice. Results indicated that application of 100% Recommended Dose of Fertilizer (RDF) + Seed treatment with microbial consortia (*Rhizobium* + PSB + KRB + Zn SB @ 25g seed^{-1}) registered significantly higher plant height, leaf area, number of branches plant^{-1}, dry matter production and nutrient uptake (N, P and K) which was statistically on par with the application of 100% RDF + Soil application of microbial consortia (*Rhizobium* + PSB+ KRB+ Zn SB @ 5 kg ha^{-1}). Quality parameters *viz*., crude protein content, protein yield, crude fibre content and fibre yield were registered higher with the same treatments. Number of nodules, fresh and dry weight of nodules plant^{-1} were higher with T_6-100% RDN through FYM + Seed treatment with microbial consortia and was on par with T_9-100% RDN through FYM + Soil application with microbial consortia. While, control recorded the lowest values for the all parameters.
Keywords: Biofertilizers, Crude protein, Crude fibre, Dry matter production, Fodder Cowpea, Microbial Consortia, Number of nodules.

Introduction

Cowpea, known locally as Bobbera, Alasanda, Lobia or Chawli, is predominantly cultivated in the Southern, Northern and Central states of India. It is an important *kharif* crop cultivated as dual purpose as seed and fodder due to its short duration, high yielding and fast growth. It is a high-yielding forage crop that can be cultivated either as sole crop or as intercrop in fodder crops such as maize, sorghum and bajra owing to high protein content (Bhavya *et al.,* 2014).

India faces a significant shortage of green fodder, leading dairy farmers to rely more on expensive concentrate feeds which in turn raises production costs. The insufficient availability of forage both in terms of quantity and quality negatively impacts the growth, health, reproduction and overall productivity of livestock. Recent estimates reveal an 11.24% deficit in green fodder, 23.4% shortage in dry fodder and 29% deficit in concentrates. To tackle this issue, experts suggest allocating 14-17% of agricultural land for fodder cultivation. Currently, only 8.4 million ha, approximately 4% of the gross cropped area are using for this purpose. Fodder production in India faces a notable imbalance shaped by factors such as livestock type, climate, socio-economic conditions and cropping patterns, cattle and buffalo in particular it depends on cultivated fodder and supplemented by gathered grasses (Dhamodharan *et al.*, 2024). Therefore, enhancing productivity and producing high-quality fodder are critical concerns for farmers. Cowpea providing a valuable protein-rich supplement for livestock nutrition. With a protein content of 15-18% and crude fibre ranging from 18-22% in its vegetative parts, cowpea serves as an excellent green fodder source, contributing to the nutritional needs of livestock (Dutta *et al.,* 2019).

Cowpea is known to form symbiotic relationships with certain nitrogen-fixing bacteria such as *Rhizobium*, which can fix the atmospheric nitrogen. In addition, it enhances soil fertility and decreases the nitrogen needs of companion or subsequent crops in rotation. However, the amount of nitrogen fixed is not always sufficient to meet the plant's growth and development, especially under high-yielding conditions.

Bio-fertilizers, an integral part of integrated nutrient management is recognized for their cost-effectiveness, eco-friendliness and renewable nature in providing plant nutrients. Unlike chemical fertilizers, bio-fertilizers offer a non-bulky, low-cost alternative and making them a vital component of sustainable agriculture practices in India. They work by enhancing soil fertility and promoting plant growth through natural processes like nitrogen fixation and phosphate solubilization, reducing the reliance on chemical inputs. In the current scenario, where chemical fertilizer prices are rising significantly, the importance of bio-fertilizers has increased. They not only help reduce costs for farmers but also contribute to environmental conservation by minimizing the harmful effects associated with excessive use of chemical fertilizers. Their role is crucial in promoting a balanced and sustainable agricultural system (Harireddy *et al.*, 2021).

Materials and Methods

The experiment was conducted during kharif, 2023 at AICRP on Forage Crops and Utilization Field at ARI, Rajendranagar, Telangana, India. The research farm is located at 17°3' N latitude, 78°39' E longitude with an altitude of 494 meters above mean sea level (MSL) within the Southern Telangana Agro-climatic zone and classified as a Semi-Arid Tropic Region (SAT) according to Troll's climatic classification. The analysis of the soil samples revealed that the soil type was sandy loam with low organic carbon content (0.44%), neutral in reaction (pH 7.5) and non-saline in nature (0.27 d S m^{-1}). The available nitrogen status of the soil was low (197.3 kg ha^{-1}) and the available phosphorus content was relatively high (38.1 kg ha^{-1}) and the available potassium content was medium (190.30 kg ha^{-1}). Throughout the crop growth period, 603.7 mm of rainfall was received in 29 rainy days. The mean weekly maximum and minimum temperatures recorded were 33.1°c and 16.1 °C, respectively. The experimental layout includes ten treatments, arranged in a randomized block design with and replicated thrice. Cowpea (variety Vijaya) was sown on 11.7.2023 with 2 seeds $hill^{-1}$ adopting spacing of 45 cm x 15 cm. Recommended dose of fertilizer (20, 40, 20 N, P_2O_5 and K_2O kg ha^{-1}) was applied through urea, SSP and MOP. Entire dose of nitrogen, phosphorus and potassium were applied as basal. The microbial consortia (*Rhizobium* + PSB + KRB + Zn SB) was applied @ 5 kg ha^{-1} (Enriched with FYM) as soil application and for seed treatment @25g kg^{-1} seed.

The biometric observations were recorded from five representative tagged plants, randomly selected from each net plot and plant height, leaf area, number of branches $plant^{-1}$, dry matter production, nutrient uptake (N, P and K), crude protein content, protein yield, crude fibre content and fibre yield, number of nodules, fresh and dry weight $plant^{-1}$ were recorded.

Statistical Analysis

The experimental data on various parameters recorded during the course of investigation were statistically analysed and employed the method of analysis of variance within a Randomized Block Design to assess the significance of the results by ANOVA procedure (Gomez and Gomez, 1984). The critical difference calculated at a 5% level of probability was utilized to determine the significance of the treatment means.

Results and Discussion

Growth parameters

The statistically analysed data presented in table 1 shows the effect of integrated nutrient management on growth parameters of fodder cowpea.

The plant height, leaf area, number of branches and dry matter production was significantly influenced due to different treatments. Application of 100% RDF + Seed treatment with microbial consortia (T_5) produced significantly higher plant height (118.6 cm), leaf area (1246.4 cm^2 $plant^{-1}$), number of branches (11.8) and dry matter production (3924.1 kg ha^{-1}) while control treatment T_1 recorded lower plant height (89.4 cm), leaf area (839.5 cm^2 $plant^{-1}$), number of branches (7.9) and dry matter production (2527.8 kg ha^{-1}). Enhanced plant height might be due to the availability of the nutrients through integrated nutrient management. Further, the crop might have better access to absorb nutrients in available from, that reflected in taller plants. These results are in conformity with the finding of Kalegore *et al.* (2018), Dutta *et al.* (2021) and Patel *et al.* (2020). Improved leaf area could be ascribed to the adequate availability of nutrients with conjunctive application of nitrogen that promoted cell elongation and expansion of leaves. These results corroborate with the finding of Ramya and Pandove (2021) and Sakpal *et al.* (2021). Increased number of branches might be due to the combined application of bio-inoculants and much provided nutrients to the plants and thereby increasing vegetative growth of plants. These results corroborate with the findings of Chauhan *et al*. (2016). Higher dry matter production might be due to the readily available nitrogen for quick initial growth and improved nutrient availability, due to conjunctive application of nitrogen (organic and inorganic forms). Furthermore, useful bacteria that colonise the rhizosphere region, such as *Rhizobium,* PSB and KRB have the capacity to fix nitrogen, solubilise phosphorus and release potassium thereby promote plant growth. These findings are in line with those of Panda *et al.* (2017), Kalegore *et al.* (2018) and Umesha *et al.* (2021).

Nutrient uptake (kg ha^{-1})

Total uptake of N (69.6 kg ha^{-1}), P (5.9 kg ha^{-1}) and K (36.1 kg ha^{-1}) at harvest were highest in T_5-100% RDF + Seed treatment with microbial consortia and it was on par with T_8-100% RDF + Soil application of microbial consortia. Whereas, the lowest N (24.4 kg ha^{-1}), P (1.7 kg ha^{-1}) and K (17.4 kg ha^{-1}) were recorded in control plot. Higher nutrient uptake in treatments T_5 and T_8 could be due to higher dry matter production and nutrient content. Heisnam *et al.* (2017), Dutta *et al*. (2021) and Rahangdale *et al.* (2022) also documented similar findings on increased nutrient uptake.

Nodule parameters

Significantly higher number, fresh and dry weight of nodules pant^{-1} at flowering were recorded in T_6-100% RDN through FYM + Seed treatment with microbial consortia which was statistically at par with T_9-100%RDN through FYM + Soil application of microbial consortia. Whereas, the lower number, fresh and dry weight of nodules were recorded in control plot. It might be due to positive impact of organic manures on the physical, chemical and biological characteristics of the soil, which helped to improve the symbiotic activity of *Rhizobium* and reflected in size of root nodules, which increased the rate and amount of nitrogen fixation and phosphorus solubilizer that enhanced the number of nodules by making more P available to the plants, which is necessary for nodule formation. Similar results on improved nodule parameters were earlier demonstrated by Pargi *et al.* (2016), Tagore *et al* (2016) and Hossain *et al.* (2017).

Quality parameters

Among the treatments, highest crude protein content (20.6 %), protein yield (8.8 q ha^{-1}), crude fibre content (30.1%) and crude fibre yield (12.7 q ha^{-1}) in stover were registered with T_5-100% RDF + Seed treatment with microbial consortia which was on par with T_8-100% RDF + Soil application of microbial consortia. While, T_1- absolute control recorded the lowest crude protein content (12.5 %), protein yield (4.0 q ha^{-1}), crude fibre content (19.8 %) and crude fibre yield (6.2 q ha^{-1}) in stover. It might be due to increased activity of the enzyme nitrate reductase which may be attributed to *Rhizobium* and PSB inoculation through microbial consortia, nitrogen and phosphorus application through inorganic manures that improved nitrogen concentration in pods. Since nitrogen is a major component of amino acids, building blocks of protein content, higher nitrogen in green pods directly translates into higher crude protein content. Crude protein yield is mainly influenced by seed yield and protein content. While, the variations in crude fibre content are limited by genetic and biochemical factors. Fibre yield is mainly influenced by stover yield and fibre content. The results are in conformity with Singh *et al.* (2018), Patel *et al.* (2020), Husain *et al.* (2021) and Sakpal *et al.* (2021).

Conclusion

From the results it could be concluded that in fodder cowpea application of 100% RDF + Seed treatment with microbial consortia (*Rhizobium* + PSB+ KRB+ Zn SB) @ 25 g kg^{-1} recorded statistically higher growth and quality parameters.

Table 1: Effect of integrated nutrient management on growth and nodule parameters of fodder cowpea.

	Treatment details	Plant height (cm)	Leaf area (cm^2)	Number of branches $plant^{-1}$	Dry matter production (kg ha^{-1})	Number of nodules $plant^{-1}$	Fresh weight of nodules $plant^{-1}$ (mg)	Dry weight of nodules $plant^{-1}$ (mg)
T_1	Absolute control	89.4	839.5	7.9	2527.8	27.1	146.3	59.6
T_2	100% RDF (20 N: 40 P_2O_5: 20 K_2O)	109.8	1144.3	10.9	3484.6	31.8	171.7	70.0
T_3	100% RDN through FYM	93.8	928.5	9.0	2926.5	38.2	206.3	84.0
T_4	50% RDN + 50% Nitrogen through FYM	95	942.4	9.4	2945.3	36.8	198.7	81.0
T_5	100% RDF + Seed treatment with microbial consortia	118.6	1246.4	11.8	3924.1	39.9	215.5	87.8
T_6	100% RDN through FYM + Seed treatment with Microbial consortia	102.1	1045.5	9.9	3069.3	47.2	254.9	103.8
T_7	50% RDN + 50% Nitrogen through FYM+ Seed treatment with microbial consortia	107.9	1116.5	10.5	3180.1	43.6	235.4	95.9
T_8	100% RDF + Soil application of microbial consortia	114.7	1207.5	11.5	3789.3	39.7	214.4	87.3
T_9	100% RDN through FYM + Soil application of microbial consortia	101.2	1023.5	9.7	3018.4	46.0	248.4	101.2
T_{10}	50% RDN + 50% Nitrogen through FYM + Soil application of microbial consortia	107.4	1094.4	10.3	3160.6	42.8	231.1	94.2
	SEm±	2.3	32.4	0.3	125.2	1.1	5.6	2.5
	CD (P = 0.05)	7.0	96.4	1.2	372.1	3.4	16.9	7.6

Table 2 : Effect of integrated nutrient management on nutrient uptake and quality parameters of fodder cowpea.

	Treatment details	Nitrogen uptake (kg ha^{-1})	Phosphorus uptake (kg ha^{-1})	Potassium uptake (kg ha^{-1})	Crude protein content (%)	Crude protein yield (q ha^{-1})	Crude fibre content (%)	Crude fibre yield (q ha^{-1})
T_1	Absolute control	24.4	1.7	17.4	12.5	4	19.8	6.2
T_2	100% RDF (20 N: 40 P_2O_5: 20 K_2O)	58.1	4.5	30.6	19.4	7.4	27.6	10.4
T_3	100% RDN through FYM	34.1	2.7	23.1	15.6	5.1	22.9	7.4
T_4	50% RDN + 50% Nitrogen through FYM	37.3	2.8	23.9	16.2	5.4	24.2	7.8
T_5	100% RDF + Seed treatment with microbial consortia	69.6	5.9	36.1	20.6	8.8	30.1	12.7
T_6	100% RDN through FYM + Seed treatment with Microbial consortia	45.1	3.3	26.1	17.5	6	25.7	8.6
T_7	50% RDN + 50% Nitrogen through FYM + Seed treatment with microbial consortia	49.9	3.9	27.3	18.1	6.4	26.8	9.3
T_8	100% RDF + Soil application of microbial consortia	66.8	5.5	34.3	20.6	8.5	29.8	12.1
T_9	100% RDN through FYM + Soil application of microbial consortia	44.2	3.4	25.4	17.5	5.9	25.3	8.4
T_{10}	50% RDN + 50% Nitrogen through FYM + Soil application of microbial consortia	49.6	3.7	27.1	17.7	6.2	26.5	9.2
	SEm±	2.0	0.2	1.1	0.4	0.3	0.8	0.3
	CD (P = 0.05)	6.0	0.7	3.1	1.2	1.0	2.3	1.0

Acknowledgement

I sincerely thank the members of the advisory committee for their continuous support and guidance. I also acknowledge Professor Jayashankar Telangana State Agricultural University for providing the necessary facilities and for granting me the opportunity to undertake this experiment.

Competing Interests

Authors have declared that no competing interests exist.

References

Bhavya, M.R., Palled, Y.B., Ullasa, M.Y and Nagaraj, R. 2014. Influence of seed rate and fertilizer levels on dry matter distribution and dry matter yield of fodder cowpea (cv. Swad). *Trends in Biosciences,* **7**(20), 3160-3165.

Chauhan, J., Paithankar, D.H., Khichi, P., Ramteke, V., Srinivas, J and Baghel, M.M. 2016. Studies on integrated nutrient management in Cowpea. *Research Journal of Agricultural Sciences*, **7**(2), 256-259.

Dhamodharan, P., Bhuvaneshwari, J., Sowmiya, S and Chinnadurai, R. 2024. Revitalizing fodder production, challenges and opportunities. *International Journal of Research in Agronomy,* **7**(1), 208-217.

Dutta, S., Singh, M., Meena, R.K., Basak, N., Mondal, G and Hindoriya, P.S. 2019. Effect of organic and inorganic nutrient sources on yield and quality of fodder cowpea (*Vigna unguiculata* L. Walp). *Indian Journal of Animal Nutrition,* **36**(2),173-178.

Gomez, K.A and Gomez, A.A. 1984. Statistical Procedure for Agriculture research. 2nd Edition. John Willey and Sons, New York. 680.

Harireddy, Y.V and Dawson, J. 2021. Effect of biofertilizers and levels of vermicompost on growth and yield of cowpea (*Vigna unguiculata* L.). *The Pharma Innovation Journal,* **10**(6), 985-988.

Heisnam, P., Sah, D., Moirangthem, A., Singh, M.C., Pandey, P.K., Mahato, N.K., Longjam, R., Debnath, P and Pandey, A.K. 2017. Effects of Rhizobium, PSB inoculation and phosphorus management on soil nutrient status and performance of cowpea in acid soil of Arunachal Pradesh, India. *International Journal of Current Microbiology and Applied Science,* **6**, 937-942.

Hossain, M.A.S., Miah, M.J., Akter, H and Islam, M.F. 2017. Growth and yield of cowpea under integrated nutrient management practices. *Journal Sylhet Agric Univ*ersity, **4**(2), 191-198.

Hussain, N., Hassan, B., Habib, R., Chand, L., Ali, A and Hussain, A. 2021. Response of biofertilizers on growth and yield attributes of black gram (*Vigna mungo* L.). *International Journal of Current Microbiology and Applied Sciences,* **2**(1), 148-150.

Kalegore, N.K., Gavhane, M.A., Bhusari, S.A., Kasle, S.V and Dhamane, R.S. 2018. Response of cowpea (*Vigna unguiculata*) to inorganic and biofertilizers. *International Journal of Economic Plants,* **5**(4), 167-169.

Panda, R.K., Sahu, G.S., Dash, S.K., Muduli, K.C., Nahak, S., Pradhan, S.R and Mangaraj, S. 2017. Integrated nutrient management for seed production in cowpea (*Vigna unguiculata* L.). *Journal of Pharmacognosy and Phytochemistry*, **6**(5), 1845-1849.

Pargi, K.L., Leva, R.L., Vaghasiya, H.Y and Patel, H.A. 2016. Integrated nutrient management in summer cowpea (*Vigna unguiculata* L.) under south Gujarat condition. *International Journal of Current Microbiology and Applied Sciences,* **7**(9), 1513-1522.

Patel, A.J., Chudasama, V.R., Patel, R.C., Mukesh Kumar and Rathod, K.D. 2020. Effect of integrated nutrient management on growth and yield of vegetable cowpea (*Vigna radiata* L.). *International Journal of Chemical Studies,* **9**(1), 1265-1268.

Rahangdale, N., Kumawat, N., Jadav, M.L., Bhagat, D.V., Singh, M and Yadav, R.K. 2022. Symbiotic efficiency, productivity and profitability of soybean as influenced by liquid bio-inoculants and straw mulch. *International Journal of Bio-resource and Stress Management,* **13**(1), 9-16.

Ramya, S and Pandove, G. 2021. Integrated nutrient management in cowpea with the application of microbial inoculants. *Legume Research-An International Journal,* **44**(3), 243-251.

Sakpal, V.M., Jagtap, D.N., Upadhyay, L., Pinjari, S.S., More, S.S., Jadhav, M.S and Bodake, P.S. 2022. Effect of Foliar Application of Different Organic Sources and Levels of Fertilizer on Growth Attributes, Yield Attributes, Yield, Quality and Economics of Cowpea (*Vigna unguiculata* L.). *Agricultural Science Digest-A Research Journal,* **42**(4), 414-419.

Singh, P., Narendera, S., Mahesh, J and Rajendra, O. (2018). Effect of Integrated Nutrient Management on growth and yield of Cowpea (*Vigna unguiculata* L.). *International Journal of Current Microbiology and Applied Sciences,* **7**, 3509-3512.

Tagore, G.S., Namdeo, S.L., Sharma, S.K and Kumar, N. (2013). Effect of Rhizobium and phosphate solubilizing bacterial inoculants on symbiotic traits, nodule leghemoglobin, and yield of chickpea genotypes. *International Journal of Agronomy,* **12**(4),232.

Umesha, C. (2021). Effect of biofertilizers and phosphorus on growth parameters and yield of cowpea (*Vigna unguiculata* L. Walp.) in sandy loam soil of Prayagraj. *Environment Conversation Journal*, **22**(2), 137-141.