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Effect of Integrated Nutrient Management on Yield and Yield Attributes of Cowpea (*Vigna unguiculata* L.) under Doon Valley Condition

V. Ganesh[*1], B. Divya Vani[2], M. Sai Kumar[2], M. Vikram Sai[2] and B. Maheswara Reddy[2]

[1]M.Sc. Agronomy, Doon PG college of Agriculture science and technology

[2] Ph.D Scholar, Department of Agronomy, Faculty of Agriculture, Annamalai University

Corresponding mail: ganeshnaidu578@gmail.com

ABSTRACT

A field trial was conducted during *kharif* season 2017 to study the "Effect of Integrated Nutrient Management on Growth and Yield in Cowpea (*Vigna unguiculata* L.). The experiment was reposed out in Randomized block design which consist of eight treatments and was replicated thrice *viz.*, Control (T_1), 25:50:25 kg NPK ha^{-1} (T_2), 25:50:25 kg NPK ha^{-1} + FYM @ 5 t ha^{-1} (T_3), 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1} (T_4), 12.5:50:25 kg NPK ha^{-1} + FYM @ 5 t ha^{-1} + Rhizobium (T_5), 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1}+ Rhizobium (T_6), 12.5:50:25 kg NPK ha^{-1} + 12.5 kg N through FYM (T_7), 12.5:50:25 kg NPK ha^{-1} + 12.5 kg N through Vermicompost (T_8). Gopi local variety is used as a test crop. The results of the findings reveal that higher no of pods, seeds pod^{-1}, grain yield and stover yield was attained by 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1} + Rhizobium.

Key words: NPK, Vermicompost, FYM, Rhizobium.

INTRODUCTION

Cowpea (*Vigna unguiculata L.*) is the most important leguminous vegetable crop. Leguminous crops play an important role in Indian Agriculture. They have a unique ability of biological nitrogen fixation, deep root system, mobilization of insoluble soil nutrient and bringing qualitative changes in the soil. It is originated from Central Africa and mainly cultivated in Asia, Africa, Central and South America. In India, it is grown on 292.77 lakh ha area, with 224.01 lakh ton production and 765 kg ha^{-1}. Productivity (Anonymous 2016-17) in the all-growing states. States like Rajasthan and the adjoining part of Himachal Pradesh have a good acreage under this crop (Das *et.al.*, 2011). It is grown as a single crop and as a mixed crop, cultivated throughout the year in the form of tender pods, forage, green manure and as cover crops.

Cowpea requires a good quantity of nutrients throughout the growth periods, especially P for better development of roots, better nodulation, and N-fixation (V.K. Choudhary, V.K and Kumar, P.S, 2014). Nitrogen plays a crucial role in various metabolic processes of plant growth. Nitrogen is an essential constituent of protein and chlorophyll (Mena *et al.*, 2014).

In addition, N and P have a stimulating effect on the root activity and rooting pattern of the crop. Phosphorus is utilized for plant metabolism and is a constituent of various organic substances; it plays an imperative role in photosynthesis, respiration and other physiological processes of the plant.

Potassium has a direct and indirect impact on plant growth. Using potassium directly causes reduced transpiration, increases water absorption or creates an internal condition in order to endure the dryness.

Bio-fertilizer promotes fertilizer use efficiency. The seed inoculated with Rhizobium increase the number of rhizospheres and enhance activities microbiologically. (Khandelwal *et al.*, 2012).

Vermicompost as organic compost and substitute for chemical fertilizer is advised by pioneers of organic farming. Earthworm processed organic waste, often referred to as vermicompost are finely divided peat-like materials with high porosity, aeration, drain ability and water holding capacity (Khan *et al.*, 2013).

Keeping in view the above facts and need for optimum use of chemical fertilizer along with organics FYM and Rhizobium and vermicompost experiment was carried out on "Effect of integrated nutrient management on growth and yield in Cowpea (*Vigna unguiculata* L.)."

MATERIALS AND METHODS

A Field trial was carried out during Kharif season 2017 at agronomy farm, Doon (PG) College of Agriculture science and technology, Dehradun (Selaqui) situated at 30"19'05" N latitude, 79.3 E longitude at an altitude of 516.5 m above the mean sea level in the Shivalik range of Himalayan foothills. This experiment was conducted with eight treatments *viz.*, Control (T_1), 25:50:25 kg NPK ha^{-1} (T_2), 25:50:25 kg NPK ha^{-1} + FYM @ 5 t ha^{-1} (T_3), 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1} (T_4), 12.5:50:25 kg NPK ha^{-1} + FYM @ 5 t ha^{-1} + Rhizobium (T_5), 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1} + Rhizobium (T_6), 12.5:50:25 kg NPK ha^{-1} + 12.5 kg N through FYM (T_7), 12.5:50:25 kg NPK ha^{-1} + 12.5 kg N through Vermicompost (T_8) laid out in Randomized block design (RBD). The plot size was 4.0 m x 5.0 m and the spacing was 30 cm x 10 cm is used for experimental research. Gopi local variety is used as a test crop. All the data observations recorded in the experiments were statistically analyzed by Web Agri Stat Package (WASP).

RESULTS AND DISCUSSION

YIELD

All the treatments showed a significant increase in no pods plant^{-1}, maximum pod weight and the number of seeds plant^{-1} over control. The highest yield characters was attained in the treatment 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1} + Rhizobium (T_4) and followed by 12.5:50:25 kg NPK ha^{-1} + FYM @ 5 t ha^{-1} + Rhizobium (T_3) and 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1} (T_7). The minimum number of pod plant^{-1} was recorded in the treatment 25:50:25 kg NPK ha^{-1} (T_2) over all the treatments, and it was higher than control (T_1). Due to the application of organic manure, inorganic fertilizers along biofertilizers increased the root nodules in the crop and thus leading to higher nutrient uptake. A similar result was reported by Bhardwaj and Harendra (2000), they reported a higher yield in Cowpea by application of 50% NPK with vermicompost. It was also supported by Khandelwal *et.al.*, (2012) conducted that the application of 75 % of the recommended dose of fertilizer, i.e., 15 kg N and 30 kg P_2O_5 ha^{-1}, along with seed inoculation by Rhizobium + PSB, proved significantly superior over rest of treatment combinations and provided significantly higher pods per plant.

Table 1. Effect of integrated nutrient management on No of pods plant^{-1}, Pod weight & No of seeds pod^{-1}

Treatments	No. of pods plant^{-1}	Pod wt. plant^{-1}	No. of seed Pod^{-1}
T_1- Control	12.47	25.20	14.22
T_2- 25:50:25 kg NPK ha^{-1}	12.75	25.53	14.84
T_3- 12.5:50:25 kg NPK ha^{-1} + FYM @ 5 t ha^{-1} + Rhizobium	15.02	28.29	16. 32
T_4- 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1} + Rhizobium	15.89	29.24	16. 40
T_5- 12.5:50:25 kg NPK ha^{-1} + 12.5 kg N through FYM	12.96	25.90	15.11
T_6- 12.5:50:25 kg NPK ha^{-1} + 12.5 kg N through Vermicompost	13.81	27.34	15.35
T_7- 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha-1	14.80	27.62	15.94
T_8-25:50:25 kg NPK ha^{-1} + FYM @ 5 t ha^{-1}	14.13	27.45	15.74
SEm±	**0.09**	**0.07**	**0.29**
CD at 5%	**0.28**	**0.22**	**0.88**

YIELD ATTRIBUTES

According to the data pertaining (Table 2) grain, the stover yield was significantly increased in all the treatments over the control. The highest grain, stover yield was obtained in the treatment 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1} + Rhizobium (T_4) followed by 12.5:50:25 kg NPK ha^{-1} + FYM @ 5 t ha^{-1} + Rhizobium (T_3) and 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1} (T_7). Whereas the minimum grain yield (kg ha^{-1}) was recorded in treatment 25:50:25 kg NPK ha^{-1} (T_2) over all the treatments, but it was higher in comparison to control (T_1). Due to the photosynthesis rate and chlorophyll content of plants, the use of organic fertilizers containing biological fertilizers has an impact on plant growth. These are in direct line with the agreements of Choudhary *et al.,* (2013), Meena *et al.,* (2014).

Table 2. Effect of integrated nutrient management on Grain & Stover yield

Treatments	Grain yield (Kg ha^{-1})	Stover yield (Kg ha^{-1})
T_1- Control	1102	661.2
T_2- 25:50:25 kg NPK ha^{-1}	1127	676.2
T_3- 12.5:50:25 kg NPK ha^{-1} + FYM @ 5 t ha^{-1} + Rhizobium	1266	759.2
T_4- 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1}+ Rhizobium	1325	795
T_5- 12.5:50:25 kg NPK ha^{-1} + 12.5 kg N through FYM	1145	687
T_6- 12.5:50:25 kg NPK ha^{-1} + 12.5 kg N through Vermicompost	1180	708
T_7- 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1}	1245	747
T_8-25:50:25 kg NPK ha^{-1} + FYM @ 5 t ha^{-1}	1220	732
SEm±	**0.7**	**0.11**
CD at 5%	**2.2**	**0.35**

CONCLUSION

From the above considerations, the data reveals that more no of pods, pod weight, seeds pod^{-1}, grain & straw yield were attained in the treatment 25:50:25 kg NPK ha^{-1} + Vermicompost @ 2 t ha^{-1}+ Rhizobium. It was due to the higher nutrient uptake and photosynthates accumulation in the pods that increased the pod weight, grain yield.

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