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Khushboo Kumari
M.Sc. Scholar, Vivekananda Global University, Jaipur, Rajasthan, India

Sharma PK
Professor, Department of Agriculture Vivekananda Global University, Jaipur, Rajasthan, India

Corresponding Author:
Khushboo Kumari
M.Sc. Scholar, Vivekananda Global University, Jaipur, Rajasthan, India

Effect of different source of nutrients on yield and economics of cowpea [*Vigna unguiculata* (L.) Walp]

Khushboo Kumari and Sharma PK

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Abstract
A field experiment was conducted at Research farm, Vivekananda Global University, Jaipur (Rajasthan) during *Kharif*, 2024 on loamy sand soil. The experiment comprising nine treatments of different source of nutrients (RDF 100% (20 kg N ha^{-1} and 40 kg P ha^{-1}), FYM @ 5.0 t/ha, FYM @ 2.5 t/ha + NPK 50% RDF, Neem cake @ 1.0 t/ha, Neem cake @ 0.5 t/ha + NPK 50% RDF, Vermicompost @ 2.0 t/ha, Vermicompost @ 0.5 t/ha + NPK 50% RDF, Poultry manure @ 1.0 t/ha and Poultry manure @ 0.5 t/ha + NPK 50% RDF) was laid out in Randomized Block Design and replicated thrice. Results showed that application of T_9 (Poultry manure @ 0.5 t/ha + NPK 50% RDF) significantly increased the grain and straw yield of 909 and 2213 kg/ha, respectively. Remaining at par with T_5 (Neem cake @ 0.5 q/ha + NPK 50% RDF) and T_3 (FYM @ 2.5 t/ha + NPK 50% RDF). Poultry manure @ 0.5 t/ha + NPK 50% RDF also fetched highest net returns (46267 Rs./ha) with the highest B: C ratio (3.72).

Keywords: Cowpea, nutrient sources, vermicompost, poultry manure

Introduction
Cowpea (*Vigna unguiculata* (L.) is the major pulses grown throughout the country during both in summer and rainy season. It is a self-pollinated leguminous crop containing 24% protein, 60% carbohydrate, 1.3% fat, 3.2% minerals, 0.9% fibre, 154 mg calcium, 385 mg phosphorus, 9.1 mg iron and small amount of vitamin B-complex. Being a short duration crop, it fits well in various multiple and intercropping systems. After removing pods, its plant may be used as good quality green or dry fodder or green manure. Being a legume, it also enriches soil by fixing atmospheric nitrogen. Cowpea contributes about 13 percent of total area and 10 percent production of pulses in our country. It was grown on 2.9 m ha area with a production of 1.96 mt and productivity of 532 kg/ha in our country (Anonymous, 2015-16). During the last decades, agricultural production has increased due to use of high yielding varieties and enhanced consumption of chemical fertilizer. This has however, been accompanied by exponential increased in the consumption of non-renewable form of energy in view of escalating energy costs. It is essential for use to evolve and adopt a strategy of using organic manures. Organic manures enhances the soil fertility and yield of crops by rendering unviable sources of elemental nitrogen bound, phosphate and decomposed plant residues into available form in order to facilitate the plant to absorb the nutrients. At present, imprudent use of chemical fertilizer, pesticides and fungicides is responsible for deterioration of soil health and ultimately your green plant. In India, most of the farmers are small and marginal. Therefore, it is very difficult for them to purchase the chemical fertilizer at the higher cost. Organic manures on the other hand are eco-friendly and cheap sources of nutrient, however it has been observed that the crop response to organic manures is not as spectacular as with chemical. But due to increasing additions of chemical fertilizer, the chemical properties of soil resulting decline in yield after continuous cropping. Therefore, to maintain the soil fertility and to supply plant nutrients in balanced proportion for optimum growth, yield and quality of crop with integrated approach is to be practiced under specific agro ecological situation through the combined use of inorganic and organic sources of plant nutrients. Organic manures *viz*., FYM, vermicompost, poultry manure and oilcakes help in the improvement of soil structure, aeration and water holding capacity of soil. Further, it stimulates the activity of microorganisms that makes the plant to get the macro and micro-

nutrients through enhanced biological processes, increase nutrient solubility, alter soil salinity, sodicity and pH. (Alabadan *et al*., 2009) [9].

Materials and Methods

The experiment was conducted at Research farm, Vivekananda Global University, Jaipur. Geographically, is situated Geographically this place is situated at 750 47' East longitude, 260 51' North latitude and at altitude of 390 m above mean sea level in Jaipur district of Rajasthan. This region falls under Agro-climatic zone IIIa (Semi-arid eastern plain zone) of Rajasthan.

Grain yield

After threshing, winnowing and cleaning, the produce of each plot was weighed separately in kg per plot and then converted to grain yield in kg/ha.

Stover yield

Stover yield (kg/ha) was obtained by subtracting grain yield (kg/ha) from the biological yield (kg/ha).

Biological yield

The weight of the thoroughly sun dried harvested produce of each plot was recorded separately before threshing and expressed as biological yield in (kg/ha).

Harvest index

Harvest index was computed by using the formula outlined by Singh and Stoskopf (1971).

$$\text{Harvest index (\%)} = \frac{\text{Economic yield (kg/ha)}}{\text{Biological yield (kg/ha)}} \text{ X } 100$$

The economics of treatments is the prime consideration before making any recommendation to the farmers for its adoption. Hence, to evaluate the effectiveness and profitability of the treatments, comprehensive economics in terms of net returns (₹ ha^{-1}) and B:C ratio was calculated so that the most effective and remunerative treatment could be recommended. The details of calculation with prevailing market rates of the inputs and produce are given in appendices at the end.

Net returns = Gross returns – Total cost of cultivation

$$\text{B: C ratio} = \frac{\text{Gross returns (₹ ha}^{-1}\text{)}}{\text{Cost of cultivation (₹ ha}^{-1}\text{)}}$$

Results and Discussion

Application of T_9 Poultry manure @ 0.5 t/ha + NPK 50% RDF significantly influent the grain yield (909 kg ha^{-1}), straw yield (2213 kg ha^{-1}) and biological yield (3123 kg ha^{-1}) over all other treatment combinations. Benefits accruing from the integrated use of organic with inorganic source of nutrient might be attributed to better supply of nutrients along with conducive physical environment leading to better root activity and higher nutrient absorption, which resulted better plant growth and superior yield attributes responsible for high yield (Thakur *et al*., 2011) [2]. Prajapati *et al*. (2016) [1] also reported the improved yield attributes of soybean with integration of synthetic fertilizers and organic manures. Photosynthates are synthesized in chloroplasts containing chlorophyll of which the nitrogen is one of the constituents and thus with the increased level of nitrogen the crop productivity also increases. Earlier Sharma *et al.* (2018) [3] also proved the significance of integrated use of organic and inorganic sources towards improvement in the crop yield of soybean. Comparable findings were reported by Mamia *et al*. (2018) [4]; Kolpe and Bodake (2017) [5]; Verma *et al.* (2017) [8]; Dhakal *et al*. (2016) [6]. Among nutrient management approaches, the application of T_9 (Poultry manure @ 0.5 t/ha + NPK 50% RDF) had considerably maximum net return (46267 Rs ha^{-1}) and maximum B:C ratio (3.72) compare to other treatment followed by treatment T_5 (Neem cake @ 1.0 t/ha) (43029 Rs.ha^{-1}), T_3 (FYM @ 2.5 t/ha + NPK 50% RDF) (38477 Rs.ha^{-1}) (Table 4.10). The higher net return and B: C ratio was associated with its higher grain and straw yield per unit of added cost. Kolpe and Bodake (2017) [5], Verma *et al*. (2017) [8] and Konthoujam *et al*. (2013) [7] also found that the economics of organic and inorganic sources of nutrient treatments resulted in significantly higher gross and net returns over control.

Table 1: Effect of different source of nutrients on yield of cowpea

Treatments	Seed yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
100% RDF (20 kg N and 40 kg P_2O_5 ha^{-1})	544	1356	1899	28.57
FYM @ 5 t/ha	355	911	1266	29.12
FYM @ 2.5 t/ha + 50% RDF	789	1932	2721	28.95
Neem cake @ 1.0 t/ha	368	943	1312	29.10
Neem cake @ 0.5 t/ha + 50% RDF	877	2137	3014	29.56
Vermicompost @ 2.0 t/ha	334	864	1198	29.22
Vermicompost @ 1.0 t/ha + 50% RDF	708	1742	2450	29.25
Poultry manure @ 1.0 t/ha	378	966	1343	29.56
Poultry manure @ 0.5 t/ha + 50% RDF	909	2213	3123	29.36
SEm±	74	155	227	0.28
CD (0.05%)	157	328	481	NS

Table 2: Effect of different nutrient sources on economics of cowpea

Treatments	Net returns	B:C ratio
100% RDF (20 kg N and 40 kg P2O5 ha-1)	23325	2.59
FYM @ 5 t/ha	5447	1.28
FYM @ 2.5 t/ha + 50% RDF	38477	3.33
Neem cake @ 1.0 t/ha	3392	1.15
Neem cake @ 0.5 t/ha + 50% RDF	43029	3.39
Vermicompost @ 2.0 t/ha	3028	1.15
Vermicompost @ 1.0 t/ha + 50% RDF	32384	2.90
Poultry manure @ 1.0 t/ha	6040	1.29
Poultry manure @ 0.5 t/ha + 50% RDF	46267	3.72
SEm±	4974	0.27
CD (0.05%)	10545	0.56

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