

Effect of Organic manures on growth and yield of Cowpea (*Vigna unguiculata* L.) varieties

ABSTRACT

A Field experiment was conducted during *Zaid* 2023 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) on Cowpea (*Vigna unguiculata* L.). The soil of experimental plot was sandy loam in texture, low in organic carbon (0.452%), nearly neutral in soil PH (7.1), Nitrogen (178.48 kg/ha), Phosphorous (23.6 kg/ha), Potassium (231.4 kg/ha). The experiment consisted of three replications which there were three cowpea varieties viz., (*Kashi Nidhi*, *Kashi Unnati*, *Kashi Kanchan*) and three organic manures (Poultry 2 t/ha, Goat 10.5 t/ha, Pig 15 t/ha) which were replicated thrice. The decomposition rate of poultry manure 0.019 per day, goat manure 0.32-0.625 per day, pig manure 0.0013 per day. The results revealed that significantly higher plant height (52.73 cm), dry weight (15.03 g/plant), crop growth rate (12.57 g/m²/day), number of pods/plant (11.80), number of seeds/plant (11.50), test weight (81.00g), seed yield (2.40 t/ha), stover yield (4.10 t/ha), harvest index (35.77%). Maximum gross returns (INR 1,14,155.00/ha), net returns (INR 79,515.00/ha) and benefit cost ratio (2.30) were also obtained in the same T₃ (*Kashi Kanchan* + Poultry manure 2 t/ha).

Key words: *Kashi Nidhi*, *Kashi Unnati*, *Kashi Kanchan*, Poultry manure, Goat manure and Pig manure.

1. Introduction

“Cowpea (*Vigna unguiculata* L.) commonly known as black eyed pea, southern pea, crowder pea, lobia or marble pea. It is an important legume vegetable crop as well as pulse grown in

India. It is summer season crop of humid tropics and sub-tropical zones, well adapted to many areas of the country including North East India. It has manifold uses such as vegetable, pulse, green manuring and fodder crop”(Punabati *et al.* 2017). “Cowpea fits very well in a various cropping system and is grown as mixed crop, cover crop, catch crop and manure crop. It has ability to withstand a considerable degree of drought and higher rainfall and can be grown in almost all kinds of soils provided there is proper drainage”(Devesh *et al.* 2020). “During 2022-23 the total coverage under cowpea in Uttar Pradesh 16900 ha with a production will be around 113200 tones and the productivity 6.70t/ha (*Agricultural statistics at a glance*, GOI).Cowpea is one of the most important vegetable crops in organic farming systems as it improves soil fertility even in marginal lands through provision of ground cover, plant residue, nitrogen fixation and suppressing weed and contributes to the sustainability of cropping systems”(Seema *et al.* 2021).

“Sustainable pulse production demands the use of fertilizers because of loss of soil fertility. To achieve sustainability in agricultural production, organic manures play a vital role in maintaining the soil fertility. Besides plant nutrients, the presence of enzymes and hormones in manure make them essential for improvement of soil fertility and productivity”(Seema *et al.* 2021). “Organic manures provide significant quantities of humus. Humus improves soil structure, drainage, aeration, holding water, buffer and exchange ability, soil mineral solubility, and serves as energy source for microorganism growth. Slow microbial breakdown of humus triggers a gradual release of plants, thereby ensuring long-term availability of nutrients” (Nigam *et al.* 2020). “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 and pH”(Deepa *et al.* 2016). “Goat manure is among the best animal manures, providing a consistent supply of nutrients. The goat manure is expected to add nutrients to soil and it also makes a change in the physical properties of the soil”(Suya *et al.* 2020). “Swine manure is reported to be effective in increasing the yields of cereals, legumes, oilseeds, vegetables and pastures, and in increasing plant nutrient concentration, especially N, P and K. The efficient use of swine manure can be an agronomically and economically viable management practice for sustainable cropproduction” Choudhary *et al.* (1996).

“Cultivable varieties are of non-synchronized maturity due to photo sensitive, spreading type and long duration in nature. As a result, farmers have to do harvesting several pickings, which costs more labour, time, and money, raising the entire cost of cultivation”(Rajneesh *et al.* 2022). “*Kashi Kanchan* is dwarf and bush type (height 50-60 cm), photo-insensitive, early flowering (40-45 days after sowing) and early picking (50-55 days after sowing) variety suitable for growing in both spring-summer and rainy seasons. Pods are about 30-35 cm long, dark green, soft, fleshy and free from parchment. The cultivar gives green pod yield of about 150-175 q/ha and is resistant to golden mosaic virus. It is suitable for cultivation in Uttar Pradesh, Punjab, Bihar, Chhattisgarh, Orissa, Andhra Pradesh, Madhya Pradesh states. *Kashi Unnati* is also a photo-insensitive variety, dwarf and bushy with height of 40-50 cm bearing early flowering (30-35 days after sowing). First harvesting done at 40-45 days after sowing produces 40-45 pods per plant. Pods are 30-35 cm long, light green, soft, fleshy and free from parchment. The cultivar is resistant to golden mosaic virus. It is suitable for the cultivation in Punjab, Uttar Pradesh and Jharkhand”(Kannan *et al.* 2019).

Kashi nidhi is dwarf, erect and bushy. Fruits and seeds are 20-25cm long. Seed colour is reddish brown. Sowing during summer. Golden mosaic virus and pseudocercospora cruenta tolerant. Pod yield of 140-150 q/ha. It is suitable cultivation in Uttar Pradesh, Bihar, Punjab states.

Justification

In India, Cowpea is grown widely throughout the year. It is one of the most essential crop in organic farming system as it contributes to the sustainability of cropping system and soil fertility improvement. Photo insensitive and unsynchronized maturity varieties costs more labour, time, and money which raises the cost of cultivation. The possible way to maximize productivity and to enhance income to farmer is by adopting organic practices and growing improved varieties.

2. Materials and Methods

The experiment was conducted during *Zaid* season of 2023, at Crop research farm of department of Agronomy at Sam Higginbottom University of Agriculture, Technology, and Sciences, Prayagraj which is located 98 m altitude above the mean sea level. The soil in the experimental

area was sandy loam texture with pH (7.1), organic carbon (0.452%), available N (178.48 kg/ha), available P (23.6 kg/ha) and available K (231.4 kg/ha) were determined by Jackson's method, Subbaiah and Asija's method, Olsen's method, Flame photometer method, respectively. The experiment was laid out in randomized block design (RBD) consisting of three cowpea varieties and three types of organic manures and were replicated thrice when applied in combinations as follows, T₁: *Kashi Nidhi* + Poultry manure, T₂: *Kashi Unnati* + Poultry manure, T₃: *Kashi Kanchan* + Poultry manure, T₄: *Kashi Nidhi* + Goat manure, T₅: *Kashi Unnati* + Goat manure, T₆: *Kashi Kanchan* + Goat manure, T₇: *Kashi Nidhi* + Pig manure, T₈: *Kashi Unnati* + Pig manure and T₉: *Kashi Kanchan* + Pig manure. The pure, healthy, disease, insect free vigorous and good quality cowpea seeds were used for sowing. Seeds were sown at a depth of 3-4 cm in lines at a spacing of 30 cm × 15 cm. Weeding was done manually at 25 and 45 days after sowing with the help of khurpi. First light irrigation was done just after sowing then subsequent irrigations were applied as per the requirement of the crop. The observations on various growth and yield parameters were recorded from the selected plants. The border plants were excluded while selecting the sample plants. Growth parameters at 15, 30, 45 and 60 days after sowing viz. plant height (cm), dry weight (g/plant), number of pods/plant, number of seeds/pod, test weight, seed yield and stover yield. The data collected was computed and statistical analysis by analysis of variance method (Gomez and Gomez 1984). The results are presented at 5% level of significance (p=0.05) for making comparison between treatments.

3. Results and Discussion

3.1 Growth attributes

At 60 DAS, significantly highest plant height (52.73 cm), dry weight (15.03g) were recorded in T₃ with *Kashi Kanchan* variety with application of poultry manure 2 t/ha. "Application of different organic manures create uptake of nutrients by the crop due to availability of nutrients. The plant growth is the function of photosynthetic activity of the plants and translocation of photosynthates within the plant which ultimately depend on their capacity to utilize available nutrients" **Deepa et al.(2016)**. Total nitrogen and phosphorus content higher in poultry manure. It contributes increase of soil nutrient content due to very high decomposition rate compared to other animal manures

Yoganathan et al. (2013) “The increase in plant height by the application of the poultry manure at the first few weeks after planting could be attributed to the quick mineralization of poultry manure as compared to goat dung which later gave higher plant heights at 8 and 10 weeks after planting. When the manure is mineralized, it makes nutrient available in inorganic forms that are easily assimilated by plants”**Onwuka and Nsofor (2011)**. Cultivating suitable variety with the application of organic manures improve growth parameters and soil properties. Poultry manure when applied alone or combined can provide the necessary nutrients needed by plants for growth **Adeoye et al. (2011)**. “Increase in leaf area was more due to combine application of organic manure. *Kashi Kanchan* variety of cowpea responded well to inorganic and organic sources of plant nutrients better as compared to inorganic nutrients alone”**Panda et al. (2017)**.

3.2 Yield attributes and Yield

“According to yield attributes data that was collected and analyzed at harvest, significantly higher number of pods/plant (11.80), number of seeds/plant (11.50), test weight (81.00 g), seed yield (2.40 t/ha) and stover yield (4.10 t/ha) were recorded in T₃ with *Kashi Kanchan* variety with application of poultry manure 2 t/ha. *Kashi Nidhi* recorded significantly higher for chlorophyll content in leaves at 60 DAS. *Kashi Nidhi* and *Kashi Kanchan* recorded high crude fibre content among other varieties”**Kumari et al. (2022)**. “Plants respond differently to environmental factors based on their genetic makeup and their adaptation capability indicating that variability among species. Maximum test weight occupied by variety *Kashi Unnati* may be due to better availability of nutrients and better translocation of photosynthates from source to sink and may be due higher accumulation of photosynthates in the seeds. Highest fibre content was highly exhibited with variety *Kashi Kanchan*”**Yogesh et al. (2016)**. “The improved physical condition of soil resulting from the addition of organic matter increased the crop yield compared to use of chemical fertilizer, Poultry manure has a beneficial effect on crop growth and yield”**Yoganathan et al. (2013)**. “The application of the amendment resulted in increased grain yields, which could be as the result of harnessing of all the nutrients in the amendments, to produce the grain yield which is the focus of the farmers in embarking on cowpea production”**Onwuka and Nsofor (2011)**. “Farmers to fetch high yields they should use chicken

manure and pig manure and plant early in time during the first rains and also crops to pick the Nitrogen flash for their vegetative growth”**Oya et al. (2023)**.

3.3 Economics (INR/ha)

Maximum gross return (INR 1,14,155.00/ha), net return (INR 79,515.00/ha) and benefit cost ratio (2.30) were obtained highest in *Kashi Kanchan* variety with application of poultry manure 2 t/ha. “Additional income attributed to the higher yield of *Kashi Kanchan* is result of increase in net income due to adoption of improved crop management practices. Cultivating improved varieties and improving cultivation techniques have been found to significantly increase yields and incomes for cowpea growers”**Rajneesh et al. (2022)**. Seed production of *Kashi Kanchan* variety of cowpea found to be profitable with application of RDF, Vermicompost and lime under Odisha agro-climatic condition **Panda et al. (2017)**.

4. CONCLUSION

It can be concluded that *Kashi Kanchan* variety with application of poultry manure 2 t/ha brought about significant improvement in the production and also proven economically viable in cowpea crop.

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Table1.Effect of organic manures on growth attributesofCowpea varieties.

S.No	Treatment combinations	60 DAS	60 DAS	45-60 DAS
		Plant height (cm)	Dry weight (g/plant)	CGR (g/m ² /day)
1.	<i>Kashi Nidhi</i> + Poultry manure 2 t/ha	50.34	12.48	9.10
2.	<i>Kashi Unnati</i> + Poultry manure 2 t/ha	51.13	12.21	8.78
3.	<i>Kashi Kanchan</i> + Poultry manure 2 t/ha	52.73	15.03	11.99
4.	<i>Kashi Nidhi</i> + Goat manure 10.5 t/ha	51.39	14.25	10.96
5.	<i>Kashi Unnati</i> + Goat manure 10.5 t/ha	50.41	14.10	11.95
6.	<i>Kashi Kanchan</i> + Goat manure 10.5 t/ha	51.66	14.83	12.57
7.	<i>Kashi Nidhi</i> + Pig manure 15 t/ha	49.93	14.20	11.24
8.	<i>Kashi Unnati</i> + Pig manure 15 t/ha	51.27	14.03	10.80
9.	<i>Kashi Kanchan</i> + Pig manure 15 t/ha	49.15	13.70	10.37
	SEm(±)	0.61	0.58	0.82
	CD(p=0.05)	1.83	1.74	-

Table 2. Effect of Organic manures on Yield attributes and Yield of Cowpea varieties.

S.No	Treatments	Number of pods/plant	Number of seeds/pod	Test weight (g)	Seed yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
1.	<i>Kashi Nidhi</i> + Poultry manure 2 t/ha	10.07	10.23	79.67	1.83	3.50	30.94
2.	<i>Kashi Unnati</i> + Poultry manure 2 t/ha	10.60	10.43	80.33	1.70	3.54	31.05
3.	<i>Kashi Kanchan</i> + Poultry manure 2t/ha	11.80	11.50	81.00	2.40	4.10	35.77
4.	<i>Kashi Nidhi</i> + Goat manure 10.5 t/ha	10.50	10.70	79.33	1.90	3.23	33.83
5.	<i>Kashi Unnati</i> + Goat manure 10.5 t/ha	10.60	10.73	78.67	1.90	3.33	34.65
6.	<i>Kashi Kanchan</i> + Goat manure 10.5 t/ha	10.47	10.43	80.33	1.87	3.37	30.28
7.	<i>Kashi Nidhi</i> + Pig manure 15 t/ha	11.23	11.10	79.67	2.33	3.40	34.03
8.	<i>Kashi Unnati</i> + Pig manure 15 t/ha	11.47	11.27	79.33	2.32	3.27	32.32
9.	<i>Kashi Kanchan</i> + Pig manure 15 t/ha	11.43	11.20	80.33	2.33	3.17	34.06
	SEm(±)	0.25	0.29	0.38	0.04	0.09	0.94
	CD(p=0.05)	0.77	-	1.14	0.12	0.28	2.82

Table3.Effect of Organic manures onEconomics of Cowpea

S.No	Treatments	Cost of cultivation (INR/ha)	Gross returns (INR/ha)	Net returns (INR/ha)	B:C ratio
1.	<i>Kashi Nidhi</i> + Poultry manure 2 t/ha	34640.00	87755.00	53115.00	1.53
2.	<i>Kashi Unnati</i> + Poultry manure 2 t/ha	34640.00	81660.00	47020.00	1.36
3.	<i>Kashi Kanchan</i> + Poultry manure 2 t/ha	34640.00	114155.00	79515.00	2.30
4.	<i>Kashi Nidhi</i> + Goat manure 10.5 t/ha	44640.00	90200.00	45560.00	1.02
5.	<i>Kashi Unnati</i> + Goat manure 10.5 t/ha	44640.00	90500.00	45860.00	1.03
6.	<i>Kashi Kanchan</i> + Goat manure10.5 t/ha	44640.00	89350.00	44710.00	1.00
7.	<i>Kashi Nidhi</i> + Pig manure 15 t/ha	66840.00	109800.00	55160.00	1.01
8.	<i>Kashi Unnati</i> + Pig manure 15 t/ha	66840.00	109150.00	54510.00	1.00
9.	<i>Kashi Kanchan</i> + Pig manure 15 t/ha	66840.00	112500.00	55060.00	1.01