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Studies on the Effect of Organic Manures and Inorganic Fertilizers on Yield Attributes, Yield and Economics of Pigeon Pea [*Cajanus cajan* (L.) Millsp.]

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ABSTRACT

Background: Pulses are an integral part of many diets across the globe and they have great potential to improve human health, conserve our soils, protect the environment and contribute to global food security. The United Nations declared 2016 as the "International Year of Pulses" (IYP) to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed at food security and nutrition. India is the largest producer, consumer, and importer of pulses in the world. Pigeonpea [*Cajanus cajan* (L.) Millsp.] is one of the major grain legume (pulse) crops of the tropics and subtropics, endowed with several unique characteristics. It finds an important place in the farming system adopted by smallholder farmers in a large number of developing countries. Although globally pigeon pea ranks sixth in area and production in comparison to other grain legumes such as beans, peas and chickpeas, it is used in more diversified ways than others.

Methods: A field experiment was conducted at Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (M.P.) during the *K* season of 2015-16 to evaluate the effect of organic manures and inorganic fertilizers on yield attributes, yield and economics of pigeon pea. Treatment comprised three organic manures (FYM @ 10 t/ha, Nadep compost @ 10 t/ha and vermin-compost @ 5 t/ha) and three levels of inorganic fertilizers (control, 100 and 50% RDF). Thus treatments were tested in a 3-replicated split plot design.

Result: The result revealed that the number of pods/plant, seeds/pod, pod length, and seed yield/plant were statistically similar in all tested organic manures but the application of vermicompost @ 5 t/ha, significantly improved the 100- seed weight. It also produced a significantly maximum seed yield of 1337 kg/ha, stover yield of 6220 kg/ha and net returns of Rs. 51727/ha. Control and use of 50 and 100% RDF in organic fertilizers gave statistically equal yield attributes (pods/plant, pod length and seeds/pod), seed yield, stover yield, gross returns and net returns of pigeon pea. The seed weight/plant and 100 seed weight were maximum under 100% RDF than control.

Key words: FYM, Nadep compost, Net returns, RDF, Seed yield, Stover yield, Vermicompost, Yield attributes.

INTRODUCTION

Pulses are an important source of protein in the diets of a large section of the vegetarian population in developing countries in general and India in particular. They are one of the important food crops globally due to their higher protein content. Pulses are also responsible for yielding large financial gains by amounting to a large part of the exports in India.

Pigeon pea (*Cajanus cajan* (L) Millsp) is a multipurpose legume proclaiming its value as a soil builder. In terms of its ecological services, pigeon pea is useful as an alley crop, in agroforestry systems, in home gardens and as a cover crop. Thus, it is an important pulse legume grown due to its wide range of products (Dasbak and Asiegbu, 2009). Pigeon pea is an excellent source of organic nitrogen and nutrient recycling. It increases organic matter and improves the soil structure and soil quality. Tabo *et al.* (1995) reported that sorghum, cassava, Bambara nuts, melons and maize can be intercropped with pigeon pea. Nutrient management is the most important basic factor and is found to exert a great influence not only on growth and yield, yield attributes of crops but also on obtaining maximum productivity. NPK is the most important nutrient which contributes to the proper growth and yield of plants as well as direct effect on the metabolism of plants.

The long-term use of inorganic fertilizers is known to degrade the physico-chemical and biological properties of soil. The integrated nutrient management having organic manures, vermicompost, biofertilizers, *etc.* improves the soil properties, its health and fertilizer use efficiency, mitigates

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the short supply of micronutrients, stimulates the proliferation of diverse groups of soil micro-organisms, and plays an important role in the maintenance of soil fertility and improves the ecological balance of rhizosphere (Singh and Singh, 2017). Organic sources of nutrients are gaining global importance in crop production and are required to be integrated with chemical fertilizers. Recycling of farm by-products has become inevitable for enhancing nutritional quality and productivity of crops as well as sustaining soil health. Therefore, the application of these nutrients in a balanced amount is important to pigeonpea because of their positive role in the root-nodulation process and protein synthesis in plants.

MATERIALS AND METHODS

The present field experiment was conducted during *kharif* season of 2015-16 at Rajaula Agriculture farm of the Mahatma Gandhi Gramodaya Vishwa Vidyalaya, Chitrakoot, Satna (M.P.). The treatments comprised three organic manures *viz*. FYM @10 t/ha, Nadep compost @ 10 t/ha, and vermicompost @ 5 t/ha, and three levels of inorganic fertilizers @ 0 (control), 50 and 100% RDF. Thus treatments were tested in a three replicated split-plot design in which organic manures were in the main plot and inorganic fertilizers in subplots. The soil of the experimental plot was sandy loam in texture having a soil pH of 7.48, low in organic carbon (0.243%), low in available nitrogen (120.16 kg/ha.), and medium in available phosphorus (20.11 kg/ha.), medium in available potassium (142 kg/ha.). The crop received 353 mm of rainfall from July to December. Pigeon pea (cv. Pusa-992) was sowing on July 4, 2015 at a row spacing of 60 cm with a seed rate of 25 kg/ha. Later on plant spacing was maintained at 15 cm by thinning of extra plants. As per treatment FYM @ 10 t/ha, Nadep compost @ 10 t/ha and vermicompost @ 5 t/ha were broadcasted after the preparation of the layout and just before sowing. The crop was fertilized @ 20:60:20 kg NPK/ha (100% RDF) and @ 10:30:10 kg NPK/ha. (50% RDF). The NPK was supplied through urea, DAP and muriate of potash, respectively. The fertilizer was placed in furrows at sowing. The crop was irrigated dated 04-9-2015 and 5-10-2015. The crop was protected from weeds through spraying of pendimethalin 30 EC@ 3.3 lit./ha, the next day of sowing. The plant protection measures were applied as per the recommendation of the crop. The crop was harvested on January 8, 2016.

RESULTS AND DISCUSSION

Effect of organic manures

It is evident from Table 1 that yield attributes of Pigeon pea *viz.* Pods/plant, pod length, seeds/pod and seed weight/plant were significantly similar in all the tested organic manures but the 100-seed weight was higher under vermicompost treated plot. In Table 2 the seed yield of Pigeon pea was significantly highest at 1337 kg/ha, under vermicompost @ 5 t/ha, which was statistically higher than FYM and Nadep compost @ 10 t/ha, treatments. It enhanced seed yield to the tune of 318 kg and 172 kg/ha, over FYM and Nadep compost, respectively. Vermicompost numerically increased stover yield over FYM and Nadep compost by a margin of 88 kg and 41 kg/ha, respectively. All manures produced almost equal yield contributing characters might be due to all organic manures providing sufficient plant nutrients in general and additional yield was might be due more favorable condition of the soil in addition to nutrients as well vitamins and hormones. The beneficial effect of organic manures on pigeon pea was supported by the findings of Sarkar *et al.* (1997) and Sharma *et al.* (2012). The cost of cultivation increased with the cost of organic manures. It was the lowest of Rs. 28200/ha. under FYM @10 t/ha and the highest of Rs. 39476/ha, in vermicompost @ 5 t/ha, The gross and net income of Rs. 91202/ha. and 51727/ha was maximum under vermicompost treated plots, respectively.

Table 1: Effect of organic manures and inorganic fertilizer on yield attributes of Pigeon pea.

Treatments	Pods / plant	Pod length (cm)	Seeds per pod	100 seed weight (g)	Seed weight per plant (g)
Organic manures					
FYM @ 10 t/ ha	61.36	3.93	3.33	7.66	17.18
Nadep compost @ 10 t/ha	65.02	4.20	3.50	7.86	17.36
Vermi compost @ 5 t /ha	62.47	3.82	3.40	9.12	17.60
S.Em.±	1.68	0.90	0.14	0.14	0.70
C.D. (p=0.05)	N.S.	N.S.	N.S.	0.58	NS
Inorganic fertilizers					
Control	63.18	3.87	3.34	7.84	16.22
50% RDF	63.24	4.01	3.49	8.14	17.52
100% RDF	62.42	4.08	3.40	8.64	18.40
S.Em.±	0.94	0.11	o.11	0.15	0.29
C.D. (p=0.05)	NS	NS	NS	0.48	0.90

N.S.: Non significant.

Table 2: Effect of organic manures and inorganic fertilizer on yield and economics of pigeon pea.

Treatments	Seed yield (kg/ha.)	Stover yield (kg/ha.)	Harvest index (%)	Cost of cultivation (Rs/ha.)	Gross returns (Rs/ha.)	Net returns (Rs/ha.)	B:C ratio
Organic manures							
FYM @ 10 t/ ha	1019	6132	33	28200	70363	41263	2.49
Nadep compost @ 10 t/ha	1165	6179	36	38451	79860	41409	2.09
Vermi compost @ 5 t /ha	1337	6220	38	39476	91202	51727	2.31
S.Em.±	9.52	39.45	0.57	-	583.93	2728	0.02
C.D. (p=0.05)	38.00	N.S.	2.00	-	2354	N.S.	0.08
Inorganic fertilizers							
Control	1160	6152	36	11084	79517	68433	2.38
50% RDF	1169	6189	36	15134	80112	64978	2.30
100% RDF	1193	6191	36	15539	81796	66257	2.21
S.Em.±	9.43	17.79	0.68	-	62083	2547	0.01
C.D. (p=0.05)	NS	N.S.	N.S.	-	N.S.	N.S.	0.06

Effect of inorganic fertilizers

Data showed that yield attributes *viz.* Pods/plant, pod length and seeds/pod were at par under control and application of 50 and 100% RDF. Seed weight/plant and 100 seed weight were significantly increased from control to 100% RDF. Seed yield and stover yield of Pigeon pea were not influenced significantly by inorganic fertilizers Table 2. It was might be due to the required quantity of nutrients was fulfilled from organic manures because of heavy doses (as FYM contains 0.5% N, 0.25% P_2O_5 and 0.25% K_2O, Nadeep compost contains 1% N + 0.5% P_2O_5 + 0.25% K_2O and vermicompost contains 1.5 to 2% N, 1% P_2O_5 and 1% K_2O). The Result were corroborated by Venkatesh and Basu (2011), Parimala *et al.* (2013) and Biyan *et al.* (2014). The cost of cultivation of Pigeon pea was increased with increasing rates of fertilizer due to increased rates of fertilizer cost. The gross return was increased numerically from control to 100% RDF. It was due to a numerical increase in seed and stover yield. The net returns were maximized of Rs. 60433/ha. It higher doses of fertilizer. It was reduced because of higher cultivation cost of pigeon pea.

CONCLUSION

It is observed that seed yield of pigeon pea highest found through application of vermicompost 5 tons/ ha followed by nadep 10 tons/ ha and FYM 10 tons/ ha but also found that benefit cast ratio is higher (FYM 2.49), than vermicompost (2.31) and nadep compost (2.03), so i suggest to the farmers should be used both FYM and vermicopost for increasing yield and soil fertility. Organic manure increase productivity of pigeon pea as well as increase biomass, availability of nutrient and also increase the physical property of soil.

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