Effect of organic manures and potassium levels on growth and yield attributes of Pearl millet (*Pennisetum glaucum* L.)

ABSTRACT

The field experiment was conducted during *rabi* 2022 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj (U.P.) India. To study the Response of Organic manures and potassium on growth and yield of Pearl millet. The treatment combinations were~~are~~ T_1: FYM 5t/ha + 30kg/ha potassium, T_2: FYM 5t/ha + 40 kg/ha potassium, T_3: FYM 5t/ha + 50kg/ha potassium, T_4: Vermicompost 5t/ha + 30 kg/ha potassium, T_5: Vermicompost 5t/ha + 40kg/ha potassium, T_6: Vermicompost 5t/ha + 50kg/ha potassium, T_7: Poultry Manure 4t/ha + 30kg/ha potassium, T_8: Poultry Manure 4t/ha + 40kg/ha potassium, T_9: Poultry Manure 4t/ha + 50kg/ha potassium, and control plot T_{10}:(RDF 80:40:40 NPK kg/ha) ~~are used. The soil of experimental plot was sandy loamy in texture, nearly neutral in soil reaction (pH 7.8), low in organic carbon (0.35%).~~ Results showed~~obtained~~ that the ~~higher~~ plant height (168.06 cm), ~~higher~~ plant dry weight (48.87 g/plant), ~~higher~~ crop growth rate (24.0 g/m^2/day), ~~higher~~ ear head length (25.07cm), ~~higher~~ number of grains/ear head (2372.69), ~~higher~~ test weight (10.92 gm), ~~higher~~ seed yield (36.90 q/ha) and ~~higher~~ stover yield (68.03 q/ha)were significantly influenced with application of Poultry Manure 4t/ha + 50 kg/ha potassium. Higher gross return (INR 86707.17/ha), higher net return (INR 58590.17/ha) and higher B:C ratio (2.08) were also recorded in treatment-9 (Poultry Manure 4t/ha + 50 kg/ha potassium).

Keywords: *Eeconomics. Ggrowth parameters , Oorganic manures and ~~, Pearl millet,~~ Ppotassium, ~~and yield attributes~~ .*

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Introduction

Pearl millet [*Pennisetum glaucum* (L.)] is one of the important millet crops of India. Among the coarse cereals, it stands next to sorghum in area and production. Rajasthan ranks first in area and production of pearl millet. Besides being a staple diet of approximately 10 per cent population of our country, it is also used ~~an~~as important fodder crop ~~also~~. It is the only cereal crop that is able to produce reliable yield under the marginal environments and simultaneously responds to excessive management conditions. Its nutritious grain forms the important component of human diet and stover forms the principal maintenance ration for ruminant livestock during the dry season. In addition, pearl millet grain is increasingly being used as feed for livestock and poultry.

Vermicompost is the product of decomposition process utilizing earthworms to turn the organic waste into high-quality compost that consists mainly of worm cast in addition to decayed organic matter (**Devi and Prakash, 2015).** Vermicomposting helps to convert the organic wastes (agro-wastes, animal manure and domestic refuse) into highly nutrient fertilizers for plant and soil **(Gajalakshmi and Abassi, 2004**).

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2.Material and Method

~~The experiment was conducted during *rabi* 2022.~~ The ~~-~~experiment~~-~~ was ~~-~~conducted ~~-~~in Randomized Block Design (RBD) which includes ten treatments that are replicated thrice and was laid out with the different treatments allocated randomly in each replication. The soil of the experimental field was sandy loam in texture, slightly alkaline reaction (pH 7.1) with low level of organic carbon (0.48%), available N (225 Kg/ha), P (13.6 kg/ha) and higher level of K (215.4 kg/ha) and the treatment combinations are as follows T_1: FYM 5t/ha + 30kg/ha potassium, T_2: FYM 5t/ha + 40 kg/ha potassium, T_3: FYM 5t/ha + 50kg/ha potassium, T_4: Vermicompost 5t/ha + 30 kg/ha potassium, T_5: Vermicompost 5t/ha + 40kg/ha potassium, T_6: Vermicompost 5t/ha + 50kg/ha potassium, T_7: Poultry Manure 4t/ha + 30kg/ha potassium, T_8: Poultry Manure 4t/ha + 40kg/ha potassium, T_9: Poultry Manure 4t/ha + 50kg/ha potassium, and control plot T10:(RDF 80:40:40 NPK kg/ha) are used~~.~~

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RESULTS AND DISCUSSION

1. Growth Parameters:

1.1. Plant Height

~~The plant height of crop which was~~The Growth parameters were recorded at 20, 40, 60 and at 80 DAS. ~~Five plants were selected randomly from each plot and tagged. The height of the plant was measured from the~~

~~base of the plant up to the tip.~~ The result of the present experiment indicates ~~The height was measured in cm.~~ The significantly higher plant height (196.73cm) was observed in treatment-9 (Poultry Manure 4 t/ha + Potassium 50 Kg/ha). it might be due to with application of poultry manure, The beneficial response of poultry manure to yield attributes might also be attributed to the availability of sufficient amounts of easily utilizable from of plant nutrients throughout the growth period and especially at critical growth periods of crop resulting in better uptake, plant vigour and superior yield attributes. The results were found to be similar with the **Fazily and Hanshul (2019).**

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Further increase in plant height is due to with the application of Potassium in higher level play's crucial role in meristematic growth through its effects on the synthesis of Phytohormones, among various plant hormones, cytokinin plays an important role in growth of the plant. Similar, results recorded by **Chauhan *et al*. (2017).**

Comment [H2]: higher crop growth rate data is missing

1.2. Dry weight

The Plant dry weight of pearl millet was recorded at 20, 40, 60, 80 DAS at Harvest differed significantly as influenced by Organic manures and Potassium levels. At 80 DAS, the higher plant dry weight (14.08 gm/plant) was observed in treatment-9 (Poultry Manure 4 t/ha + Potassium 50 kg/ha). However, treatment-8 (Poultry Manure 4 t/ha + Potassium 40 kg/ha) was found to be statistically at par with treatment- 9 (Poultry Manure 4 t/ha + Potassium 50 kg/ha).The significantly higher plant dry weight (14.08 gm/plant) was observed with the application of Poultry manure, the increase in the total dry matter production may be due to better source and sink capacity developed due to better dry matter production and its accumulation in assimilatory surface area and increase in the photosynthetic efficiency and thus increased the production of photosynthesis reflected in better growth and ultimately in higher dry accumulation. ~~The result.~~ The results were found to be similar with **Bhattacharya *et al*. (2003).**

Where as ~~And also,~~ increase in dry matter might be due to with the application of potassium it involved in number of physiological processes, protein synthesis and activation of enzymes. In the present investigation, the crop responded up to 50 kg K_2O/ha. Potassium aggregating agent which is known to have positive effect on soil physical properties such as plant height, healthy growth etc., and subsequently crop yields.

2. Yield Parameters:

2.1. Ear head length

The significant and higher ear head length (25.07 cm) was observed in treatment-9 with (Poultry Manure 4 t/ha + Potassium 50 kg/ha), which was significantly superior over rest of the treatments. However, treatment-8 (Poultry Manure 4 t/ha + Potassium 40 kg/ha), was found to be statistically at par with treatment-9 (Poultry Manure 4 t/ha + Potassium 50 kg/ha).

Potassium aggregating agent which is known to have positive effect on soil physical properties such as plant height, healthy growth etc and subsequently crop yields. Similar results reported by **Srinivasa *et al*. (2019).**

2.2. Number of grains/ear head

The significant and higher number of grains/ear head (2372.69) was observed in treatment-9 with (Poultry Manure 4 t/ha + Potassium 50 kg/ha), which was significantly superior over rest of the treatments. However, treatment-8 (Poultry Manure 4 t/ha + Potassium 40 kg/ha), was found to be statistically at par with treatment-9 (Poultry Manure 4 t/ha + Potassium 50 kg/ha).

Further increase in number of grains with the significant effect of potassium, Application of potassium improved the number of grains per head which might be due to the favorable effects of potassium on nutrient uptake, photosynthetic activity, improving its mobilization reported by **Yadav *et al.* (2011).**

Comment [H3]: Test weight data is missing

2.3. Grain yield (q/ha)

The significant and higher grain yield (36.90) was observed in treatment-9 with (Poultry Manure 4 t/ha + Potassium 50 kg/ha), which was significantly superior over rest of the treatments. However, treatment-8 (Poultry Manure 4 t/ha + Potassium 40 kg/ha), was found to be statistically at par with treatment-9 (Poultry Manure 4 t/ha + Potassium 50 kg/ha).

These findings are conformity with **Jagadeesha *et al.* (2010)**. Further, increase in grain yield with application of Potassium at 50 kg/ha it stimulates the cumulative effect improvement in yield attributes viz., ear head length, number of grains/ear head, test weight and enhances the development of strong cell walls and therefore stiffer straw which might be resulted into profuse tillering **(Kacha *et al.*, 2011).**

2.4 Stover yield (q/ha)

The significant and higher grain yield (68.03) was observed in treatment-9 with (Poultry Manure 4 t/ha + Potassium 50 kg/ha), which was significantly superior over rest of the treatments. However, treatment-8 (Poultry Manure 4 t/ha + Potassium 40 kg/ha), was found

to be statistically at par with treatment-9 (Poultry Manure 4 t/ha + Potassium 50 kg/ha)**.** And also, an increase in uptake of plant nutrients empowered the plant to manufacture more quantity of photosynthates resulting in more stover yield. Similar r~~R~~esults were reported by **Thumar *et al.* (2016).**

Comment [H4]:

3. Economic Analysis

Observations regarding economics of different treatments of pearl millet are given in table 3.

3.1 Gross Returns (INR/ha)

The maximum gross return (86,707.17 INR/ha) was found in treatment-9 (Poultry Manure 4t/ha + Potassium 50 kg/ha).

3.2 Net Returns (INR/ha)

The maximum net return (58,590.17INR/ha) was found in treatment-9 (Poultry Manure 4t/ha + Potassium 50 kg/ha).

Comment [H5]: Discussion is missing

3.3 Benefit Cost Ratio (B:C)

The maximum benefit Cost ratio (2.08) was found in treatment-9 with Poultry Manure 4t/ha + Potassium 50 kg/ha).

Table 1. Effect of organic manures and potassium on yield attributes of Pearl millet.

S.No.	Treatments	80 DAS		60-80 DAS	
		Plant height (cm)	**Plant dry weight(g)**	**Crop growth rate ($g/m^2/day$)**	**Relative growth rate (g/g/day)**
1.	FYM 5t/ha + Potassium 30 kg/ha	163.71	37.97	16.1	0.015
2.	FYM 5t/ha + Potassium 40 kg/ha	165.80	39.61	18.4	0.016
3.	FYM 5t/ha + Potassium 50 kg/ha	168.96	41.66	20.5	0.018
4.	Vermicompost 5t/ha + Potassium 30 kg/ha	169.71	42.55	20.4	0.017
5.	Vermicompost 5t/ha + Potassium 40 kg/ha	171.87	43.84	21.2	0.017
6.	Vermicompost 5t/ha + Potassium 50 kg/ha	173.96	45.68	21.9	0.017
7.	Poultry Manure 4t/ha + Potassium 30 kg/ha	172.27	44.96	19.3	0.015
8.	Poultry Manure 4t/ha + Potassium 40 kg/ha	175.05	47.60	22.6	0.017
9.	Poultry Manure 4t/ha + Potassium 50 kg/ha	178.06	48.87	24.0	0.018
10.	Control(RDF 80:40:40 NPK kg/ha)	165.23	38.64	16.0	0.014
	S Em(±)	1.95	0.61	1.06	0.001
	CD (P=0.05)	5.79	1.82	3.14	-

Table 2. Effect of organic manures and potassium on yield attributes of Pearl millet.

S. No.	Treatments	Ear head length (cm)	Grains/Ear head	Test weight (g)	Seed yield (q/ha)	Stover yield (q/ha)	Harvest index (%)
1.	FYM 5t/ha + 30kg/ha potassium	17.07	2023.79	8.50	24.26	54.56	30.75
2.	FYM 5t/ha + 40kg/ha potassium	17.87	2079.36	9.07	26.74	57.87	31.61
3.	FYM 5t/ha + 50kg/ha potassium	18.91	2184.02	9.21	28.25	59.11	32.40
4.	Vermicompost 5t/ha + 30kg/ha potassium	20.61	2084.47	9.32	27.60	58.65	32.04
5.	Vermicompost 5t/ha + 40kg/ha potassium	21.42	2146.27	10.17	31.20	62.70	33.26
6.	Vermicompost 5t/ha + 50kg/ha potassium	22.02	2148.41	10.41	32.60	64.69	33.50
7.	Poultry Manure 4t/ha + 30kg/ha potassium	23.39	2188.61	8.87	28.16	61.00	31.57
8.	Poultry Manure 4t/ha + 40kg/ha potassium	24.14	2246.42	10.21	33.43	63.99	34.20
9.	Poultry Manure 4t/ha + 50kg/ha potassium	25.07	2372.69	10.92	36.90	68.03	35.18
10.	Control(80:40:40 NPK kg/ha)	19.30	2030.02	8.85	25.69	55.12	31.80
	F-Test	S	S	NS	S	S	NS
	SEm±	0.46	32.27	0.58	0.85	1.97	0.91
	CD (P=0.05)	1.35	96.37	--	3.53	5.85	--

Table 3.Effect of organic manures and potassium on economic analysis of Pearl millet.

S. No.	Treatments	Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C Ratio
1.	FYM 5t/ha + 30kg/ha potassium	27450.00	57018.83	29568.83	1.08
2.	FYM 5t/ha + 40kg/ha potassium	27783.00	62839.56	35056.00	1.26
3.	FYM 5t/ha + 50kg/ha potassium	28117.00	66379.67	38262.67	1.36
4.	Vermicompost 5t/ha + 30kg/ha potassium	29950.00	64852.17	34902.17	1.17
5.	Vermicompost 5t/ha + 40kg/ha potassium	30283.00	73320.45	43037.00	1.42
6.	Vermicompost 5t/ha + 50kg/ha potassium	30617.00	76610.83	45993.00	1.50
7.	Poultry Manure 4t/ha + 30kg/ha potassium	27450.00	66183.83	38733.83	1.41
8.	Poultry Manure 4t/ha + 40kg/ha potassium	27783.00	78153.17	50370.17	1.81
9.	Poultry Manure 4t/ha + 50kg/ha potassium	28117.00	86707.17	58590.17	2.08
10.	Control(80:40:40 NPK kg/ha)	23450.00	60379.33	36929.33	1.57

CONCLUSION

It is concluded that in pearl millet with the combination of poultry manure (4 t/ha) along with Potassium (50 kg/ha) (Treatment-9) was observed highest grain yield and benefit cost ratio.

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