

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

Formatted: Centered

Abstract

A field experiment was conducted during *kharif* 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.6), low in organic carbon (0.51%), available N (230 kg ha^{-1}), available P (17.80 kg ha^{-1}) and available K ($245.10 \text{ kg ha}^{-1}$). The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice on the basis of one year experimentation. The treatments which are T₁: FYM 5 t ha^{-1} + vermicompost 3 t ha^{-1} , T₂: FYM 5 t ha^{-1} + poultry manure 2 t ha^{-1} , T₃: FYM 5 t ha^{-1} + vermicompost 1.5 t ha^{-1} + poultry manure 1 t ha^{-1} , T₄: FYM 7.5 t ha^{-1} + vermicompost 3 t ha^{-1} , T₅: FYM 7.5 t ha^{-1} + poultry manure 2 t ha^{-1} , T₆: FYM 7.5 t ha^{-1} + vermicompost 1.5 t ha^{-1} + poultry manure 1 t ha^{-1} , T₇: FYM 10 t ha^{-1} + vermicompost 3 t ha^{-1} , T₈: FYM 10 t ha^{-1} + poultry manure 2 t ha^{-1} , T₉: FYM 10 t ha^{-1} + vermicompost 1.5 t ha^{-1} + poultry manure 1 t ha^{-1} , are used. The results showed that application of FYM 10 t ha^{-1} + vermicompost 1.5 t ha^{-1} + poultry manure 1 t ha^{-1} was recorded significantly higher Plant height (174.21 cm), Plant dry weight (45.67 g). Whereas significantly highest crop growth rate ($16.72 \text{ g m}^{-2} \text{ day}^{-1}$) and relative growth rate (0.0411 g/g/day) was recorded with the treatment FYM 7.5 t ha^{-1} + vermicompost 1.5 t ha^{-1} + poultry manure 1 t ha^{-1} . Significantly maximum Number of ear heads/ m^2 (44.67), Number of grains/earhead (1976.67), Test weight (9.05 g), Grain yield (2.59 t ha^{-1}), Straw yield (3.64 t ha^{-1}), Gross returns (Rs.1,55,400.00), Net returns (Rs.94600.00) and Benefit Cost ratio (1.56) were obtained with ~~n~~ application of FYM 10 t ha^{-1} + vermicompost 1.5 t ha^{-1} + poultry manure 1 t ha^{-1} as compared to other treatments.

Key words: FYM, Vermicompost, Poultry manure, Yield.

Comment [KKBK1]: Review the summary

Comment [KKBK2]: What is U.P, need to explain?

Comment [KKBK3]: Need to explain FYM?

Comment [KKBK4]: Error!!!!!!

Introduction

Pearl millet (*Pennisetum glaucum*. L) is the most widely cultivated cereal in India after rice and wheat. It is grown on more than 9.3m ha with current grain production of 9.5 m tonnes and productivity of 1044 kg/ha⁻¹. The major growing states in Indi are Rajasthan, Maharashtra, Gujarat, Punjab, Haryana and Uttar Pradesh where, it is grown both in Kharif and summer season. Mineral fertilization is one of the most important ways for qualitative and quantitative improving crop yield and its quality can be improved by adequate soil and crop management practices (Pathak et al., [1]2012).

The nutritive value of grains of pearl millet is fairly high and used for human consumption. Apart from grain, the forage and stover is an important secondary product for resource poor farmer that can be used as animal feed and fuel. Pearl millet is a tropical cereal and most drought resistant crop is extensively grown in the arid and semi-arid regions of the world.

The application of organic sources of nutrients not only supplies all essential nutrients but also facilitates the growth and development of beneficial microbes, assists better uptake of nutrients by crop plants and counteracts the harmful effect of agrochemicals. Moreover, use of organics helps in improving water holding capacity of soil, allows better root growth and leaves residual effect on soil fertility for long period, thus organics are important for sustainable farming (Bana et al., [2]2012).

Research on use of this poultry manure resource had not been conducted. Most of the reported studies on poultry manure use as nutrient source and to improve soil properties have been conducted in developed countries, but environmental problems have arisen (Mahimairaja et al., [3]1995).

Vermicompost improves microbial load in soil and increases microbial availability of phosphorous and nitrogen which increases yield attributes and nutrient uptake (N, P and K) by grain and stover (Narolia et al., [4]2009).

Comment [KKBK5]: You have to review your introduction and enrich it with a lot of bibliographies.

Comment [KKBK6]: you have to adopt all your quotes like that.

Formatted: Font: Not Bold

Formatted: Font: Not Bold, Not Italic

Formatted: Font: Not Bold

Formatted: Font: Not Bold

Formatted: Font: Not Bold

Formatted: Font: Not Bold, Not Italic

Formatted: Font: Not Bold

Formatted: Font: Not Bold

Formatted: Font: Not Bold, Not Italic

Formatted: Font: Not Bold

Formatted: Font: Not Bold

Formatted: Font: Not Bold

Formatted: Font: Not Bold, Not Italic

Formatted: Font: Not Bold

Materials and Methods

The present examination was carried out during *Kharif* 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, UP, which is located at 25°24'41.27" N latitude, 81°50'56" E longitude and 98 m altitude above the mean sea level. The experiment laid out in Randomized Block Design which consisting of nine treatments with T₁: FYM 5 t_{ha}⁻¹ + vermicompost 3 t_{ha}⁻¹, T₂: FYM 5 t_{ha}⁻¹ + poultry manure 2 t_{ha}⁻¹, T₃: FYM 5 t_{ha}⁻¹ + vermicompost 1.5 t_{ha}⁻¹ + poultry manure 1 t_{ha}⁻¹, T₄: FYM 7.5 t_{ha}⁻¹ + vermicompost 3 t_{ha}⁻¹, T₅: FYM 7.5 t_{ha}⁻¹ + poultry manure 2 t_{ha}⁻¹, T₆: FYM 7.5 t_{ha}⁻¹ + vermicompost 1.5 t_{ha}⁻¹ + poultry manure 1 t_{ha}⁻¹, T₇: FYM 10 t_{ha}⁻¹ + vermicompost 3 t_{ha}⁻¹, T₈: FYM 10 t_{ha}⁻¹ + poultry manure 2 t_{ha}⁻¹, T₉: FYM 10 t_{ha}⁻¹ + vermicompost 1.5 t_{ha}⁻¹ + poultry manure 1 t_{ha}⁻¹ are used.

The experimental site was uniform in topography and sandy loam in texture, nearly neutral in soil reaction (P^H 7.6), low in Organic carbon (0.51%), medium available N (230 kg ha⁻¹), higher available P (17.80 kg-ha⁻¹) and medium available K (245.10 kg-ha⁻¹). In the period from germination to harvest several plant growth parameters were recorded at frequent intervals along with it after harvest several yield parameters were recorded those parameters are growth parameters, plant height and plant dry weight are recorded. The yield parameters like earheads per m², grains per earhead, test weight, grain yield (t_{ha}⁻¹) and straw yield (t_{ha}⁻¹) were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design (Gomez K.A. and Gomez A.A. 1984).

Formatted: Superscript

Formatted: Superscript

Results and Discussion

Growth attributes

Plant height

Treatment with FYM 10_t/ha⁻¹ + Vermicompost 1.5_t/ha⁻¹ + poultry manure 1t/ha recorded significantly highest plant height (174.21 cm) which was superior to all the treatments and the treatment with FYM 7.5_t/ha⁻¹ + vermicompost 1.5_t/ha⁻¹ + poultry manure 1_t/ha⁻¹ was statistically on par with the treatment FYM 10_t/ha⁻¹ + vermicompost 1.5_t/ha⁻¹ + poultry manure 1_t/ha⁻¹.

The balanced nutrition due to release of macro and micro nutrients due to application of vermicompost and FYM under favourable environment might have helped in higher uptake of nutrients. This accelerated the growth of new tissues and development of new shoots that have ultimately increased the plant height and dry matter accumulation. The results are in conformity with those of (Kumar *et al.*, 2014) and (Thumar *et al.*, 2016) in pearl millet.

Plant dry weight (g/plant)

Treatment with FYM 10_t/ha⁻¹ + vermicompost 1.5_t/ha⁻¹ + poultry manure 1_t/ha⁻¹ recorded significantly highest plant dry weight (45.67_g) which was superior to all the treatments and the treatment with FYM 7.5_t/ha⁻¹ + vermicompost 1.5_t/ha⁻¹ + poultry manure 1_t/ha⁻¹ was statistically on par with the treatment FYM 10_t/ha⁻¹ + vermicompost 1.5_t/ha⁻¹ + poultry manure 1_t/ha⁻¹.

However, maximum dry matter accumulation days to 50% flowering, were observed with vermicompost + biofertilizer. Superiority of vermicompost + biofertilizer treatment is contributed by vermicompost application enriching the supply of all the essential macro and micronutrients higher than other organic sources and secondly, the use of vermicompost had incorporated some earthworms in the field which could have worked in the soil and helped in improving the physical conditions of the soil thus increasing aeration for root development and more availability of nutrients. The vermicompost enhanced soil physical, chemical and biological properties and thus overall vegetative growth of the crop (Bana *et al.*, 2012)

Comment [KKBK7]: You have mixed results and discussion, whereas if you refer to the format of the journal anywhere, we have mixed results and discussion.

Comment [KKBK8]: This part is badly written, it must necessarily respect the format of the journal.

Comment [KKBK9]: Include all citations and follow the format of the journal.

Yield attributes and Yield

Number of spikes/m²

Maximum Number of earheads/m² (44.67) were recorded with treatment FYM 10_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure 1_t_{ha}⁻¹ which was superior over rest of all treatments and the treatment with FYM 7.5_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure 1_t_{ha}⁻¹ was statistically on par with the treatment FYM 10_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure 1_t_{ha}⁻¹.

Formatted: Superscript

The increased growth provided greater site for photosynthesis and diversion of photosynthates towards sink (ear and grain). (Yadav *et al.*, 2019)

Formatted: Right: 0.06", Space Before: 0 pt, Line spacing: 1.5 lines

The length of earhead, weight of earhead will be increased due to the application of poultry manure along with the recommended dose of fertilizer. (Senthilkumar *et al.*, 2018)

Comment [KKBK10]: Comply of the format

Number of grains/earhead

Maximum Number of grains/spike (1976.67) were recorded with the treatment FYM 10_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure 1_t_{ha}⁻¹ which was superior over rest of all treatments and the treatment with FYM 7.5_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure 1t/ha was statistically on par with the treatment FYM 10_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure 1_t_{ha}⁻¹.

The application of Vermicompost had significantly increased plant height, dry matter accumulation, ear length, grains/earhead, test weight, grain yield. The phosphorous content in grain was significantly increased due to application of vermicompost. (Togas *et al.*, 2017)

Test weight (g)

Highest test weight (9.05 g) was recorded with the treatment FYM 10_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure 1t/ha which was superior over rest of all treatments and the treatment with FYM 7.5_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure 1t/ha was statistically on par with the treatment FYM 10_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure 1_t_{ha}⁻¹.

Formatted: Indent: First line: 0.5", Right: 0.05", Space Before: 0 pt, Line spacing: Multiple 1.5 li

This might be due to application of FYM enhanced plant height, number of tillers, test weight, grain yield and straw yield. (Barad *et al.*, 2017)

Grain yield (t_{ha}⁻¹)

Highest grain yield (2.59 t_{ha}⁻¹) was recorded in the treatment FYM 10_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure 1_t_{ha}⁻¹ which was superior over rest of all treatments and the treatment with FYM 7.5_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure 1t/ha was statistically on par with the treatment FYM 10_t_{ha}⁻¹ + vermicompost 1.5_t_{ha}⁻¹ + poultry manure

The synergistic effect of integration of organic and inorganic sources along with biofertilizers resulted in better nutrient uptake, which accelerated the photosynthetic rate, adequate biomass production that reflected on grain and stover yield. The results were also obtained by (Kumar and Gautam, 2004), (Patel *et al.*, 2014) and (Parihar *et al.*, 2014).

Straw yield (t/ha^{-1})

Highest Straw yield ($3.64 t/ha^{-1}$) was seen in the treatment FYM $10 t/ha^{-1}$ + vermicompost $1.5 t/ha^{-1}$ + poultry manure $1 t/ha^{-1}$ which was superior over rest of all treatments and the treatment with FYM $7.5 t/ha^{-1}$ + vermicompost $1.5 t/ha^{-1}$ + poultry manure $1 t/ha^{-1}$ was statistically on par with the treatment FYM $10 t/ha^{-1}$ + vermicompost $1.5 t/ha^{-1}$ + poultry manure $1 t/ha$.

The use of bio-fertilizer (*Azotobacter* + PSB) along with FYM $2.5 t/ha^{-1}$ led to higher availability of N and P as well as promoted root growth, which is promoted yield attributes characters. (Thumar *et al.*, 2016)

Harvest Index (%)

Highest Harvest index (41.79%) was seen in the treatment FYM $10 t/ha^{-1}$ + vermicompost $1.5 t/ha^{-1}$ + poultry manure $1 t/ha^{-1}$ which was superior over rest of all treatments and the treatment with FYM $7.5 t/ha^{-1}$ + vermicompost $1.5 t/ha$ + poultry manure $1 t/ha^{-1}$ was statistically on par with the treatment FYM $10 t/ha^{-1}$ + vermicompost $1.5 t/ha^{-1}$ + poultry manure $1 t/ha^{-1}$.

CONCLUSION

~~It is concluded that application~~The application of treatment FYM 10_t_{ha⁻¹} + vermicompost 1.5_t_{ha⁻¹} + poultry manure 1_t_{ha⁻¹} was recorded significantly higher grain yield (2.59 t_{ha⁻¹}), higher gross returns (Rs.1,55,400.00/ha), net returns (Rs.94,600.00/ha) and benefit cost ratio (1.56) as compared to other treatments. Hence the treatment FYM 10_t_{ha⁻¹} + vermicompost 1.5_t_{ha⁻¹} + poultry manure 1_t_{ha⁻¹} could be recommended for the Eastern U.P conditions. is recommended for the Eastern U.P conditions.

Comment [KKBK11]: The conclusion is a summary of the results, so you have to review your conclusion.

Comment [KKBK12]: Utilisez le mode conditionnel.

REFERENCES

1. Bana R.S, Gautam R.C, Rana K.S. ~~2012~~, Effect of different organic sources on productivity and quality of pearl millet. *Ann. Agric. Res. New Series*. ~~2012~~; 33(3):126-130.
 2. Barad H.L, Patel C.K, Patel D.K, Sharma Seema, Joshi J.R. ~~2017~~, Effect of organic manures and inorganic fertilizers on yield, quality and economics on summer pearl mullet. *International Journal of Science and Technology*. ~~2017~~; 6(4): 2224-2231.
 3. Choudhary R, Yadav L.R, Shivran A.C, Parihar S. ~~2014~~. Effect of vermicompost and fertility levels on growth, yield, nutrient uptakr and net returns in pearl millet. *Indian J. Journal of Agricultural S-sciences*. ~~2014~~; 84(11):1428-1430.
- Kumar G, Kurothe R.S, Brajendra, Vishwakarma A.K, Rao B.K, Pande V.C, 2014. Effect of farm yard manure and fertilizer application on crop yield, runoff and soil erosion and soil organic carbon under rainfed pearl millet. *Indian Journal of Agricultural Sciences* **84**(7):816-823.
- Mahimaraja S, Bolan N.S, Hedley M.J 1995, Agronomic effectiveness of poultry manure composts. *Comm. Soil Sci. Plant Analysis* **26**:1843-1861.
- Narendra K, Gautam R.C, 2004. Effect of moisture conservation and nutrient management practices on growth and yield of pearl millet. *Indian journal of Agricultural sciences* **49**(3):182-185.
- Narolia R.S, Poonia B.L, Yadav R.S, 2009. Effect of vermicompost and inorganic fertilizers on productivity of pearl millet (*Pennisetum glaucum*). *Indian journal of Agricultural Sciences* **79**(7):506-509.
- Pathak G.C, Gupta B, Pandey N 2012, Improving reproductive efficiency of chickpea by foliar appliocation of zinc. *Braz. J. Plant Physiol.* **24**(3):173-180.
- Ramdev Togas, Yadav L.R, Choudhary S.L, Shisuvinahalli G.V, 2017. Effect of integrated use of fertilizer and manures on growth, yield and quality of Pearl millet. *Int.J.Curr.Microbial.App.Sci* **6**(8):2510-2516.
- Senthilkumar N, Poonkodi P, Prabhu N 2018, Response of pearl millet to integrated use of organics and fertilizers. *Journal of Ecobiotechnology* **10**:01-04.

Comment [KKBK13]: All references should be reviewed in accordance with the format of the journal. For example, there are some journal names are abbreviated and some are not. you really have to conform to the references of the journal.

Comment [KKBK14]: You need the real name of the journal, it is not necessary to abbreviate the name of the journal.

Formatted: Font: Not Italic

Formatted: Font: Not Italic

Formatted: Font: Not Italic

Formatted: Font: Not Bold

Formatted: Font: Not Italic

Formatted: Font: Not Bold

Formatted: Font: Not Italic

Formatted: Font: Not Italic

Comment [KKBK15]: Comply with the magazine's format!

Formatted: Font: Not Italic

Formatted: Font: Not Bold

Formatted: English (U.S.)

Thumar C.M, Dudhat M.S, Chaudhari N.N, Hadiya N.J, Ahir N.B 2016, Growth yield attributes, yield and economics of summer pearl millet (*Pennisetum glaucum* L.) as influenced by integrated nutrient management. *International Journal of Agriculture Sciences* **8**(59):3344-3346.

Yadav P.K, Verma R, Bamboriya J.K, Yadav S, Jeeterwal R.C 2019, Response of Pearl Millet to Integrated Nitrogen Management. *International Journal of Current Microbiology and Applied Sciences* **8**(2):429-437.

Table 1: Effect of Organic manures on growth attributes of Pearl millet

Treatments	Plant height (cm)	Plant dry weight (g)
1. FYM 5t/ha + vermicompost 3t/ha	170.65	33.93
2. FYM 5t/ha + poultry manure 2t/ha	169.74	33.25
3. FYM 5t/ha + vermicompost 1.5t/ha + poultry manure 1t/ha	173.71	43.28
4. FYM 7.5t/ha + vermicompost 3t/ha	171.66	38.11
5. FYM 7.5t/ha + poultry manure 2t/ha	171.09	37.24
6. FYM 7.5t/ha + vermicompost 1.5t/ha + poultry manure 1t/ha	173.89	44.78
7. FYM 10t/ha + vermicompost 3t/ha	172.68	42.24
8. FYM 10t/ha + poultry manure 2t/ha	172.18	40.68
9. FYM 10t/ha + vermicompost 1.5t/ha + poultry manure 1t/ha	174.21	45.67
F-Test	S	S
Sem±	0.28	0.34
CD at 5%	0.85	1.01

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

Treatments	No.of earheads/ m ²	No.of grains/ earhead	Test weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index (%)
1. FYM 5t/ha + vermicompost 3t/ha	36.00	1743.33	8.32	2.24	3.35	40.07
2. FYM 5t/ha + poultry manure 2t/ha	37.33	1646.67	8.17	2.18	3.25	40.14
3. FYM 5t/ha vermicompost 1.5t/ha + poultry manure 1t/ha	43.33	1928.67	8.86	2.31	3.59	39.12
4. FYM 7.5t/ha + vermicompost 3t/ha	38.33	1834.67	8.54	2.29	3.48	39.66
5. FYM 7.5t/ha + poultry manure 2t/ha	39.00	1788.00	8.41	2.25	3.44	39.61
6. FYM 7.5t/ha + vermicompost 1.5t/ha + poultry manure 1t/ha	44.33	1947.67	8.95	2.48	3.61	40.98
7. FYM 10t/ha + vermicompost 3t/ha	40.33	1912.67	8.73	2.45	3.54	41.38
8. FYM 10t/ha + poultry manure 2t/ha	41.67	1854.00	8.59	2.35	3.51	40.12
9. FYM 10t/ha + vermicompost 1.5t/ha + poultry manure 1t/ha	44.67	1976.67	9.05	2.59	3.64	41.17
F-Test	S	S	S	S	S	S
Sem±	0.84	23.25	0.04	0.03	0.02	0.18
CD at 5%	2.51	69.71	0.11	0.09	0.05	0.53

Formatted: French (France)