Original Research Article

Effect of organic manures and fish amino acid on growth and yield of foxtail millet (*Setaria italica* L.)

Abstract

A field experiment was conducted during *zaid* season of 2022 at an experimental field of the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj, Uttar Pradesh, India to determine the "Effect of organic manures and fish amino acid on growth and yield of foxtail millet (*Setaria italica* L.)". The treatments consist of FYM 10t/ha, poultry manure 1.6t/ha, *vermicompost* 1.6t/ha and foliar application of fish amino acid with 1%, 2%, 3% and control. The variety taken was SIA 3156. The experiment was carried out through a statistical design of Randomized Block Design with 10 treatments, replicated thrice. Report of the study indicate that, among different treatments application of poultry manure 1.6 t/ha and fish amino acid 3% produced significantly higher plant height (94.03 cm), plant dry weight (20.98 g), number of tillers/hill (5.27), crop growth rate (0.458g/m^2/day), leaf area index (0.066), number of spikes/plant (4.27), length of spike (16.14 cm), number of grains/spike (3081.20), test weight (3.71 g), grain yield (2.35 t/ha), straw yield (5.53 t/ha) and harvest index (30.64).

Key words: FYM, poultry manure, vermicompost, fish amino acid, growth, yield.

Introduction

Foxtail millet (*Setaria italica* L.) is known as Italian millet and in local language it is called korralu, Kangu, Kangani, Koni and Kaon in different parts of India. Foxtail millet is thought to be indigenous to Southern Asia and is considered one of the oldest cultivated millets **(Oelke, 1990).** And it is cultivated for food, grain, hay and pasture. It has an important place in world agriculture providing food for millions of people in arid and semiarid regions. In worldwide area under cultivation is 1.057 m.ha and production is 2.29 m.tons. In India area under the cultivation of small millets is 24.02 m.ha, production is 47.48 m.tons and its productivity is 1976 kg/ha (**Directorate of Economics & statistics, DAC&FW 2020).** It is nutritionally superior to conventional food grains in terms of higher protein, dietary fiber which play an important role in the energy requirement and nutrient intake of human and exhibits hypoglycemic effect due to presence of higher proportion of unavailable complex carbohydrate.

FYM application has been reported to improve crop growth by supplying plant nutrients including micronutrients as well as improving soil physical, chemical, and biological properties **(Dejene and Lemlem, 2012).** Faster water infiltration rate due to enhanced soil aggregation is the other benefit of FYM amendments to soil **(Bhatacharyya *et al.*, 2008). Poultry manure** had the greatest content of organic C, N, P, K, Ca and lowest C:N ratio reported by **Bakayoko *et al*. (2009)**. Poultry manure have been found to be richer in nitrogen than other livestock wastes **(Hirzel *et al.*, 2007).** It reduces the loss of nitrogen due to slow-release pattern of manures **(Govindappa *et al.*, 2009).**

Organic manure like ***vermicompost*** is a rich mixture of macro and micro plant nutrients. It increases the availability of nitrogen and phosphorus and improves microbial action in soil **(Choudhary *et al.*, 2014).** The importance of *vermicompost* as a source of humus and in improving the soil fertility and soil health has been well established **(Madegowda, 1997; Vasanthi and Kumaraswamy, 1996; Romaniuk *et al.*, 2011 and Murugan and Swarnam 2013). Fish amino acid** is liquid organic manure made from fish waste. Fish amino acid contains a rich quantity of amino acids which induces the protein synthesis of plant. It is of a great value to both plants and microorganisms because it contains various nutrients and types of amino acids. **(Ramesh *et al.*, 2020)**

Materials and Methods

The experiment was carried out during the *zaid* season of 2022 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P) which is located at 25º 24' 42" N latitude, 81°50' 56" E longitude, and 98 m altitude above the mean sea level. The experiment was laid out in Randomized Block Design which consisting of ten treatments with T_1: FYM (10 t/ha) + FAA (2%), T_2: FYM (10 t/ha) + FAA (3%), T_3: FYM (10 t/ha) + FAA (4%), T_4: Poultry manure (1.6 t/ha) + FAA (2%), T_5: Poultry manure (1.6 t/ha) + FAA (3%), T_6: Poultry manure (1.6 t/ha) + FAA (4%), T_7: *Vermicompost* (1.6 t/ha) + FAA (2%), T_8: *Vermicompost* (1.6 t/ha) + FAA (3%), T_9: *Vermicompost* (1.6 t/ha) + FAA (4%), T_{10}: Control plot (N: P: K = 50:30:20 kg/ha) are used. The experimental site was uniform in topography and sandy loam in texture, nearly neutral in soil reaction (P^H 7.1), low in Organic carbon (0.69%), medium available N (271.81 kg/ha), higher available P (30.19 kg/ha) and medium available K (331 kg/ha). 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. Growth parameters are plant height, number of tillers/hill and plant dry weight are recorded. The yield parameters like number of grains/spike, grain yield, stover yield and harvest index were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design **(Gomez K.A. and Gomez A.A. 1984).**

Results and Discussion

Growth attributes

Plant height

Significantly higher plant height (94.03 cm) was observed in treatment 5 (Poultry manure 1.6 t/ha + FAA3%). However, treatment 9 (*Vermicompost* 1.6 t/ha + FAA 4%) was statistically at par with treatment 5 (Poultry manure 1.6 t/ha + FAA 3%).

Significant and higher plant height was recorded with application of poultry manure (1.6 t/ha) could be due to poultry manure being an important supplier of high nitrogen accumulation, which might have helped in growth of the plant, resulted, increased in higher plant height. Similar findings was reported by **Ledhan *et al*. (2021).**

Number of tillers/hill

Significantly higher number of tillers/hill (3.27) was observed in treatment 5 (Poultry manure1.6 t/ha + FAA3%). However, treatment 9 (*Vermicompost* 1.6 t/ha + FAA 4%) is statistically at par with treatment 5(Poultry manure 1.6 t/ha + FAA 3%).

Highest number of tillers/hill was observed with application of poultry manure (1.6 t/ha) might be due to released nutrients in the poultry manure and its import into the plant, resulted, increased growth through increased cell number and tiller. Similar findings was reported by **Damar *et al.* (2016).**

Plant dry weight (g)

Significantly higher plant dry weight (20.98 g) was observed in treatment 5 (Poultry manure 1.6 t/ha + FAA3%). However, treatment 9 (*Vermicompost* 1.6 t/ha + FAA4%) is statistically at par with treatment 5 (Poultry manure 1.6 t/ha + FAA3%).

Significant and higher plant dry weight was observed with application of poultry manure (1.6 t/ha) could be due to the availability and adequate supply of organic matter by the poultry manure. Which may contributed to the increase of dry weight. Similar results were obtained by **Uhwa *et al.* (2014).**

Yield attrubutes and Yield

Number of grains/spike

The significant and higher number of grains/spike (3081.20) was observed in treatment 5 (Poultry manure1.6 t/ha + FAA3%), which was significantly superior over rest of

the treatments. However, treatment 9 (*Vermicompost* 1.6 t/ha + FAA 4%), was found to be statistically at par with treatment 5 (Poultry manure 1.6 t/ha + FAA3%).

Higher number of grains/spike was recorded with application of poultry manure (1.6 t/ha) could be due to the residual effect of organic manure which have favorably affected the balance of macro and micronutrients which increased plant growth and increased assimilates for producing more grains/spike. Similar findings was reported by **Shah *et al.* (2017).**

Test weight (g)

The significant and higher test weight (3.71 g) was observed in treatment 5 (Poultry manure1.6 t/ha + FAA3%), which was significantly superior over rest of the treatments. However, treatment 9 (*Vermicompost* 1.6 t/ha + FAA 4%), was found to be statistically at par with treatment 5 (Poultry manure 1.6 t/ha + FAA3%).

Higher test weight was recorded with the application of poultry manure (1.6 t/ha) could be due to higher concentration of macro and micronutrients added to soil in the form of poultry manure, resulted, in increased availability of nutrients in root zone, thus more uptake by crop, resulted, in higher values of test weight. Similar findings was reported by **Jagadeesha *et al.* (2010).**

Grain yield (t/ha)

The significant and higher grain yield (2.35 t/ha) was observed in treatment 5 (Poultry manure1.6 t/ha + FAA3%), which was significantly superior over rest of the treatments. However, treatment 9 (*Vermicompost* 1.6 t/ha + FAA 4%), was found to be statistically at par with treatment 5 (Poultry manure 1.6 t/ha + FAA3%).

The significant and highest grain yield was obtained with application of poultry manure (1.6 t/ha) could be the release of essential nutrient elements by the poultry manure and increase of nutrient availability, resulted in more nutrient uptake and higher dry matter accumulation per plant and its subsequent translocation to the developing spike. Similar findings was reported by **Goud *et al.* (2021).** Other reason, for increase in grain yield was foliar spray of FAA3% which was a positive and synergetic effect, resulted, increased in grain yield **Debbarma *et al.* (2015)** in rice crop.

CONCLUSION

It is concluded that application of poultry manure 1.6 t/ha along with fish amino acid 3% has performed better in growth parameters and yield attributes of foxtail millet and also recorded higher yield, when compared to other treatments.

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Table 1: Effect of organic manures and fish amino acid on growth parameters of foxtail millet

	Treatments	Plant height (cm)	number of tillers/hill	Plant dry weight(g)
1.	FYM10t/ha + FAA 2%	85.01	1.93	16.83
2.	FYM10t/ha + FAA 3%	86.97	2.27	17.17
3.	FYM10t/ha + FAA 4%	82.59	2.47	18.47
4.	Poultry manure 1.6t/ha + FAA 2%	86.78	2.60	18.90
5.	Poultry manure 1.6t/ha + FAA 3%	94.03	3.27	20.98
6.	Poultry manure 1.6t/ha + FAA 4%	86.63	2.27	17.72
7.	*Vermicompost* 1.6t/ha + FAA 2%	76.09	1.53	15.62
8.	*Vermicompost* 1.6t/ha + FAA 3%	88.46	2.73	19.68
9.	*Vermicompost* 1.6t/ha + FAA 4%	91.69	3.07	20.31
10.	Control plot (N:P: K = 50:30:20 Kg/ha)	88.74	2.67	19.38
	F- test	S	S	S
	S. EM (±)	1.97	0.07	0.37
	C. D. (P = 0.05)	8.01	0.20	1.09

Table 2. Effect of organic manures and fish amino acid on Yield and Yield attributes of foxtail millet

	Treatments	Number of grains/spike	Test weight (g)	Grain yield (t/ha)
1.	FYM10t/ha + FAA 2%	1838.07	3.04	1.62
2.	FYM10t/ha + FAA 3%	2232.40	3.17	1.65
3.	FYM10t/ha + FAA 4%	2584.13	3.35	1.70
4.	Poultry manure 1.6t/ha + FAA 2%	2672.80	3.40	1.74
5.	Poultry manure 1.6t/ha + FAA 3%	3081.20	3.71	2.35
6.	Poultry manure 1.6t/ha + FAA 4%	2498.13	3.28	1.68
7.	*Vermicompost* 1.6t/ha + FAA 2%	1724.60	2.95	1.58
8.	*Vermicompost* 1.6t/ha + FAA 3%	2788.40	3.55	2.13
9.	*Vermicompost* 1.6t/ha + FAA 4%	3056.13	3.63	2.27
10.	Control plot (N:P:K = 50:30:20 Kg/ha)	2716.47	3.46	1.77
	F test	S	S	S
	S. EM (±)	70.17	0.04	0.02
	CD (P = 0.05)	208.48	0.12	0.07