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Effect of organic manures on growth and yield of varieties of little millet (*Panicum sumatrense*)

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Abstract
A field experiment was conducted during *Kharif* 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36%), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out in Randomized Complete Block Design (RCBD) with nine treatments each replicated thrice on the based on one year experimentation. The treatments which are T_1: DHLM 36-3 + FYM @ 8t/ha, T_2: DHLM 36-3 + Neem cake @ 1t/ha, T_3: DHLM 36-3 + Vermicompost @ 2.5t/ha, T_4: JV 8 + FYM @ 8t/ha, T_5: JV 8 + Neem cake @ 1t/ha, T_6: JV 8 + Vermicompost @ 2.5t/ha, T_7: BL-6 + FYM @ 8t/ha, T_8: BL-6 + Neem cake @ 1t/ha, T_9: BL-6 + Vermicompost @ 2.5t/ha are used. The results showed that application of BL-6 + Vermicompost @ 2.5t/ha was recorded significantly higher plant height (113.98 cm), number of effective tillers/hill (10.96), Plant dry weight (26.30 g/plant), No. of effective tillers/hill (14.83), No. of grains/panicle (335.49), Test weight (2.59 g), Grain yield (1.62 t/ha), Straw yield (4.58 t/ha) and Harvest index (26.07%) as compared to other treatments.

Keywords: DHLM 36-3, JV-8, BL-6, FYM, Neem cake, Vermicompost, yield

Introduction
Little millet is one of the minor millet, which belongs to the family Poaceae. It is another reliable catch crop because of its earliness and resistance to adverse agro-climatic conditions of high drought as well as water logging. It is grown throughout India and a traditional crop of Karnataka. It is mostly cropped with other millets, pulses and oilseeds. It is generally consumed as rice and any recipe that demands staple rice can be prepared using little millet. It is described as a "quick -growing, short duration cereal which withstands both drought and water logging". Doubtless this is a valuable crop in difficult situations. It occurs as a wild crop in Northern India and South-Eastern Asia. It will yield some grain and useful fodder under very poor conditions. The crop is a balanced and staple food for tribal and economically poor sections of the population. It provides low priced proteins, minerals and vitamins in the form of sustainable food. The stover is a good fodder for cattle. Each 100 g little millet grain contains 65.5 g carbohydrate, 10.1 g protein, 3.89 g fat, 346 Kcal energy, 7.7 g dietary fiber, 16.1 mg calcium, 130 mg phosphorus, 91 mg magnesium, 1.8 mg zinc, 1.2 mg iron, 0.26 mg thiamin, 0.05 mg riboflavin, 1.3 mg niacin and 362µg folic acid (Venkatesh Bhat *et al*. 2018) [12].

Millets are small seeded coarse cereals; that belongs to the family *Poaceae*, widely cultivated in the world, mainly in Eurasia and Africa in arid and tropical regions. Minor millets were important food crops of the past and presently claimed as the future foods considering the ill effects of global warming and climate change pronounced more prominently in fragile ecological conditions. These can be adapted to a wide range of temperature, moisture-regime and input conditions and can be a potential option for providing food and feed to millions of smallholders of drylands and domestic animals. Moreover, as C_4 plant, millets sequester carbon, thereby adding to CO_2 reduction opportunities, contribute to improved agro-biodiversity by their diversity and allow mutually beneficial intercropping with other vital crops (Brahma Chari *et al*. 2018) [3]. The acreage of small millets in India is around 7.0 lakh ha with productivity of 633 kg ha^{-1} (Anbukkani *et al*. 2017) [1].

Organic manures are the key components in Integrated nutrient Management of millets under rained conditions. The normal requirement of FYM for different crops ranges from 5 to 15 t ha-1. However, the availability of organic manures is decreasing due to the reduction in cattle population and hence, an alternate and locally available organic fertilizer source needs

the demand and for avoiding complete reliance on organic manures. Recycling of crop residues/stubbles into useful manure is a sound option and is the need of the hour, apart from being an environmentally viable technology (Sudheendra *et al.*, 2014).

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 25.28°N latitude, 81.54°E longitude and 98 m altitude above the mean sea level. The experiment laid out in Randomized Complete Block Design which consisting of nine treatments with T_1: DHLM 36-3 + FYM @ 8t/ha, T_2: DHLM 36-3 + Neem cake @ 1t/ha, T_3: DHLM 36-3 + Vermicompost @ 2.5t/ha, T_4: JV 8 + FYM @ 8t/ha, T_5: JV 8 + Neem cake @ 1t/ha, T_6: JV 8 + Vermicompost @ 2.5t/ha, T_7: BL-6 + FYM @ 8t/ha, T_8: BL-6 + Neem cake @ 1t/ha, T_9: BL-6 + Vermicompost @ 2.5t/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 (0.38%), medium available N (225 kg ha^{-1}), higher available P (19.50 kg ha^{-1}) and medium available K (213.7 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, no. of tillers/plant and plant dry weight are recorded. The yield parameters like Effective tiller/hill, grains per panicle, test weight, grain yield (t/ha), stover yield (t/ha) and harvest index were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Complete Block Design.

Results and Discussion

Growth attributes

Plant height

Significantly highest plant height (113.98 cm) was recorded in the treatment with BL-6 + FYM @ 8t/ha over all the other treatments. However, the treatments with application of JV 8 + FYM @ 8t/ha (113.07 cm) and BL-6 + Vermicompost @ 2.5t/ha (113.62 cm) which were found to be at par with treatment BL-6 + FYM @ 8t/ha as compared to all the treatments.

The probable reason for the influence in plant height might be due to BL-6 variety proved superior over other varieties and the application of FYM might have favored better root proliferation, more solubility of phosphorous which consequently favored higher biological nitrogen fixation and uptake of nutrients and availability of all plant nutrients during the crop growth period. This resulted in the higher plant height and the results are in close conformity with the findings of Raundal and Patil (2017) [8] and Togas *et al.* (2017) [11].

Number of Tillers/hill

Treatment with BL-6 + FYM @ 8t/ha was recorded with significantly highest number of tillers/hill (10.96) over all the treatments. However, the treatments with JV 8 + FYM @ 8t/ha (10.75) and BL-6 + Vermicompost @ 2.5t/ha (10.86) which were found to be statistically at par with BL-6 + FYM @ 8t/ha.

The variety BL-6 recorded higher number of tillers compared to DHLM 36-3 and JV 8 variety. The probable reason might be due to the genetical potential of the variety that has helped in producing higher number of tillers and also the higher number of tillers due to the application of Farmyard manure might be due to the availability of desired and required quantity of nutrients for longer period in root zone of growing plants which helped plant cells to divide. The results were found to in correspondence with Ashwini *et al*. (2021) [2] and Wailare and Kesarwani (2017) [13].

Plant dry weight (g/plant)

Treatment with BL-6 + FYM @ 8t/ha was recorded with significantly maximum dry weight (26.30 g/hill) over all the treatments. However, the treatments JV 8 + FYM @ 8t/ha (25.90 g/hill) and BL-6 + Vermicompost @ 2.5t/ha (26.08 g/hill) which were found to be statistically at par with BL-6 + FYM @ 8t/ha.

BL-6 variety showed highest dry weight due to the higher growth and biomass accumulation when compared to other varieties. Similar trends were observed by Singh *et al*. (2015) [9].

The increase in the total dry matter production may be due to better source and sink capacity developed due to better dry matter production with the application of FYM and its accumulation in assimilatory surface area and increase in the photosynthetic efficiency and thus increased the production of photosynthates reflected in better growth and ultimately in higher dry accumulation. The results were found to be similar with Kumar *et al*. (2017) [7]

Yield attrubutes and yield

Number of effective tillers/hill

Significantly Maximum No. of effective tillers/hill (14.83) was recorded with the treatment of application of BL-6 + FYM @ 8t/ha over all the treatments. However, the treatments JV 8 + FYM @ 8t/ha (14.36) and BL-6 + Vermicompost @ 2.5t/ha (14.58) which were found to be statistically at par with BL-6 + FYM @ 8t/ha.

Number of grains/panicle

Significantly Maximum No. of grains/panicle (335.49) was recorded with the treatment of application of BL-6 + FYM @ 8t/ha over all the treatments. However, the treatments BL-6 + Vermicompost @ 2.5t/ha (321.06) which was found to be statistically at par with BL-6 + FYM @ 8t/ha.

The performance of BL-6 variety as regard of yield attributes was found to be superior. The probable reason for this may be the genetic make-up of the variety that has helped in improving the photosynthetic activity due to increased source capacity and efficient translocation of photosynthesis to the sink. The results were in accordance with Srikanya *et al.* (2020) [10].

Test weight

Significantly highest Test weight (2.59 g) was recorded with the treatment of application of BL-6 + FYM @ 8t/ha over all the treatments. However, the treatments JV 8 + FYM @ 8t/ha (2.49 g) and BL-6 + Vermicompost @ 2.5t/ha (2.52 g) which were found to be statistically at par with BL-6 + FYM @ 8t/ha.

Farmyard manure application might have influenced into increased number of tillers and extensive root system and the greater production of metabolites and their translocation to various sinks especially the productive structures (panicles

and grains) could have helped to increase into the number of panicles per plant besides increasing the overall growth. The results were found to be similar with Fazily and Hanshul (2019) [5].

Grain yield: Significantly highest Grain yield (1.62 t/ha) was recorded with the treatment application of BL-6 + FYM @ 8t/ha over all the treatments. However, the treatments with (1.55 t/ha) in JV 8 + FYM @ 8t/ha and with (1.60 t/ha) in BL-6 + Vermicompost @ 2.5t/ha which were found to be statistically at par with BL-6 + FYM @ 8t/ha.

The performance of little millet varieties in respect of grain yield was very encouraging and followed a similar trend to that of yield attributes. The little millet variety BL-6 recorded higher seed yield and straw yield over other varieties might be due to the higher production efficiency that has been reflected through improvement in different yield attributing characters. Similar findings were reported by Chamely *et al*. (2015) [4].

The higher increase in the yield has been reported to be associated with the release of macro and micro nutrients during the course of microbial decomposition and also functions as source of energy for soil micro flora brings the transformation of other nutrients in soil or applied through other means, in a form that is readily utilized by growing plants which helped in increase of seed yield. The results were in accordance with Jagadeesha *et al*. (2010) [6].

Stover yield: Significantly highest stover yield (4.58 t/ha) was recorded with the treatment application of BL-6 + FYM @ 8t/ha over all the treatments. However, the treatments with (4.36 t/ha) in JV 8 + FYM @ 8t/ha and BL-6 + Vermicompost @ 2.5t/ha (4.49/ha) which were found to be statistically at par with BL-6 + Vermicompost @ 2.5t/ha.

The beneficial response of FYM to dry matter and 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, vigour plant and superior yield attributes. The results were found to be similar with Togas *et al*. (2017) [11].

Harvest Index

Significantly highest Harvest index (26.25%) was recorded with the treatment application of BL-6 + FYM @ 8t/ha over all the treatments. However, the treatments with (26.07%) in BL-6 + FYM @ 8t/ha, BL-6 + Neem cake @ 1t/ha (25.79%) and BL-6 + Vermicompost @ 2.5t/ha (26.31%) which were found to be statistically at par with BL-6 + FYM @ 8t/ha.

Table 1: Effect of Organic manures on growth attributes of varieties of Little millet

Treatments		Plant height (cm)	Tillers/hill	Dry weight (g/plant)
1.	DHLM 36-3 + FYM @ 8t/ha	111.76	10.57	25.04
2.	DHLM 36-3 + Neem cake @ 1t/ha	109.81	10.22	24.07
3.	DHLM 36-3 + Vermicompost @ 2.5t/ha	110.23	10.31	24.46
4.	JV 8 + FYM @ 8t/ha	113.07	10.75	25.90
5.	JV 8 + Neem cake @ 1t/ha	110.94	10.42	24.89
6.	JV 8 + Vermicompost @ 2.5t/ha	112.20	10.61	25.35
7.	BL-6 + FYM @ 8t/ha	113.98	10.96	26.30
8.	BL-6 + Neem cake @ 1t/ha	112.64	10.68	25.64
9.	BL-6 + Vermicompost @ 2.5t/ha	113.62	10.86	26.08
F- test		S	S	S
S.Em (±)		0.32	0.07	0.14
CD(P = 0.05)		0.97	0.22	0.41

Table 2: Effect of Organic manures on Yield Attributes and Yield of varieties of Little millet

Treatments		No. of effective tillers/hill	No. of grains/panicle	Test Weight (g)	Grain yield (t/ha)	Stover yield (t/ha)	Harvest Index (%)
1.	DHLM 36-3 + FYM @ 8t/ha	13.50	253.29	2.31	1.36	4.14	24.81
2.	DHLM 36-3 + Neem cake @ 1t/ha	12.85	205.53	2.08	1.01	3.87	20.68
3.	DHLM 36-3 + Vermicompost @ 2.5t/ha	13.03	220.23	2.12	1.12	3.96	22.07
4.	JV 8 + FYM @ 8t/ha	14.36	302.25	2.49	1.55	4.36	26.25
5.	JV 8 + Neem cake @ 1t/ha	13.26	232.99	2.22	1.26	4.07	23.65
6.	JV 8 + Vermicompost @ 2.5t/ha	13.85	264.31	2.37	1.42	4.23	25.08
7.	BL-6 + FYM @ 8t/ha	14.83	335.49	2.59	1.62	4.58	26.07
8.	BL-6 + Neem cake @ 1t/ha	14.14	286.79	2.40	1.49	4.29	25.79
9.	BL-6 + Vermicompost @ 2.5t/ha	14.58	321.06	2.52	1.60	4.49	26.31
F test		**S**	**S**	**S**	**S**	**S**	**S**
S.Em (±)		0.16	5.07	0.03	0.03	0.08	0.39
CD(P = 0.05)		0.49	15.19	0.10	0.09	0.25	1.15

Conclusion

It is concluded that application of treatment BL-6 + FYM @ 8t/ha was recorded significantly higher Grain yield (1.62 t/ha) as compared to other treatments. Since, the findings based on the research done in one season.

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