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

Shaik Nazeema and Biswarup Mehera

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 7.1), low in organic carbon (0.51%), available N (230 kg/ha), available P (17.80 kg/ha) and available K (245.10 kg/ha). The experiment was laid out in Randomized Block Design with ten treatments each replicated thrice on the basis of one year experimentation. The treatments which are T1: Salicylic acid 100ppm + FYM 10t/ha, T2: Salicylic acid 100ppm + Vermicompost 5t/ha, T3: Salicylic acid 100ppm + Poultry manure 3t/ha, T4: Brassinosteroids 0.1ppm + FYM 10t/ha, T5: Brassinosteroids 0.1ppm + Vermicompost 5t/ha, T6: Brassinosteroids 0.1ppm + Poultry manure 3t/ha, T7: NAA 40ppm + FYM 10t/ha, T8: NAA 40ppm + Vermicompost 5t/ha, T9: NAA 40ppm + Poultry manure 3t/ha, T10: Control are used. The results showed that application of Brassinosteroids 0.1ppm + FYM 10t/ha was recorded significantly higher Plant height (176.15 cm), Number of tillers/m² (5.33), Plant dry weight (47.11g). Whereas significantly highest crop growth rate (16.71 g/m²/day) and relative growth rate (0.0383 g/g/day) was recorded with the treatment Brassinosteroids 0.1ppm + Vermicompost 5t/ha. Significantly maximum Number of spikes/m² (46.33), Number of grains/spikes (1992.67), Test weight (11.48g), Grain yield (2.76 t/ha), Straw yield (3.84 t/ha), Harvest Index (41.79%), Gross returns (Rs.1,65,000.00), Net returns (Rs.1,20,510.00) and Benefit Cost ratio (2.67) were obtained with application of Brassinosteroids 0.1ppm + FYM 10t/ha as compared to other treatments.

Keywords: FYM, brassinosteroids, salicylic acid, yield

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 9.5m tonnes and productivity of 1044 kg/ha. The major growing states in India 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.*, 2012) [5].

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.*, 1995) [4].

The plant growth regulators have potential for increasing crop productivity under environmental stress. Nutrient levels and plant growth regulators application had significant influence on growth parameters of Pearl millet. The exogenous applications of Salicylic acid (SA), Brassinosteroids (BRs) and NAA to improve growth and yield under various stress conditions including drought, salinity, extreme temperatures and heavy metal toxicity (Salem *et al.*, 2020) [6].

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 ten treatments with T1: Salicylic acid 100ppm + FYM 10t/ha, T2: Salicylic acid 100ppm + Vermicompost 5t/ha, T3: Salicylic acid 100ppm + Poultry manure 3t/ha, T4: Brassinosteroids 0.1ppm + FYM 10t/ha,

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T5: Brassinosteroids 0.1ppm + Vermicompost 5t/ha, T6: Brassinosteroids 0.1ppm + Poultry manure 3t/ha, T7: NAA 40ppm + FYM 10t/ha, T8: NAA 40ppm + Vermicompost 5t/ha, T9: NAA 40ppm + Poultry manure 3t/ha, T10: Control are used.

The experimental site was uniform in topography and sandy loam in texture, nearly neutral in soil reaction (PH 7.1), 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, no. of nodules per plant, branches per plant and plant dry weight are recorded. The yield parameters like spikes per m², grains per spike, test weight, grain yield (kg/ha) and straw yield (kg/ha) 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

Treatment with Brassinosteroids 0.1ppm + FYM 10t/ha recorded significantly highest plant height (176.15 cm) which was superior to all the treatments and the treatment with Brassinosteroids 0.1ppm + vermicompost 5t/ha was statistically on par with the treatment Brassinosteroids 0.1ppm + FYM 10t/ha.

Among the different treatments the highest plant height was recorded under 125% recommended NPK + vermicompost at 5t/ha at all stages of crop growth. This treatment was found to be significantly superior to other treatments by recording highest plant height 56.77, 175.20 and 182.60cm at 30,60 nd 90DAS respectively. (Senthilkumar *et al.*, 2018)^[7]

Number of tillers/m²

Treatment with Brassinosteroids 0.1ppm + FYM 10t/ha recorded significantly highest tillers/m² (5.33) which was superior to all the treatments and the treatments with Brassinosteroids 0.1ppm + vermicompost 5t/ha and NAA 40ppm + FYM 10t/ha were statistically on par with the treatment Brassinosteroids 0.1ppm + FYM 10t/ha.

Highest number of tillers/plant (4.93) were recorded under the treatment T9 (T1 + FYM 2.5t/ha + *Azotobacter* + PSB). This treatment proved superior because FYM application improves the soil-physical properties, hydraulic conductivity of the soil and also the availability of NPK which increased the plant growth. The superiority of this treatment over the rest of the combinations of fertilizers might also be due to higher availability of NO₃-N and production of growth-promoting substances. (Thumar *et al.*, 2016)^[9].

Plant dry weight (g/plant)

Treatment with Brassinosteroids 0.1ppm + FYM 10t/ha recorded significantly highest plant dry weight (47.11g) which was superior to all the treatments and the treatments with Brassinosteroids 0.1ppm + Vermicompost 5t/ha and NAA 40ppm + FYM 10t/ha were statistically on par with the treatment Brassinosteroids 0.1ppm + FYM 10t/ha. 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)^[2]

Yield attributes and Yield Number of spikes/m²

Maximum Number of spikes/m² (46.33) were recorded with treatment Brassinosteroids 0.1ppm + FYM 10t/ha which was superior over rest of all treatments and the treatments with Brassinosteroids 0.1ppm + vermicompost 5t/ha and NAA 40ppm + FYM 10t/ha were statistically on par with the treatment Brassinosteroids 0.1ppm + FYM 10t/ha.

The increased growth provided greater site for photosynthesis and diversion of photosynthates towards sink (ear and grain). (Yadav *et al.*, 2019)^[10]

This might be due to application of growth regulator enhanced growth attributing characters and yield attributing characters like number tillers, earhead weight and also the nutrient uptake by finger millet genotype effectively help to produce more yield. (Ashwini *et al.*, 2021)^[11]

Number of grains/spike

Maximum Number of grains/spike (1992.67) were recorded with the treatment Brassinosteroids 0.1ppm + FYM 10t/ha which was superior over rest of all treatments and the treatments with Brassinosteroids 0.1ppm + vermicompost 5t/ha and NAA 40ppm + FYM 10t/ha were statistically on par with the treatment Brassinosteroids 0.1ppm + FYM 10t/ha.

The beneficial effect on yield attributes might also be due to the increased supply of all the essential nutrients by vermicompost and FYM that might have resulted in higher manufacture of food and its subsequent partitioning towards sink. (Yadav *et al.*, 2019)^[10]

Test weight (g)

Highest test weight (11.48 g) was recorded with the treatment Brassinosteroids 0.1ppm + FYM 10t/ha which was superior over rest of all treatments and the treatments with Brassinosteroids 0.1ppm + vermicompost 5t/ha and NAA 40ppm + FYM 10t/ha were statistically on par with the treatment Brassinosteroids 0.1ppm + FYM 10t/ha.

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)^[3]

Grain yield (t/ha)

Highest grain yield (2.76 t/ha) was recorded in the treatment Brassinosteroids 0.1ppm + FYM 10t/ha which was superior over rest of all treatments and the treatments with Brassinosteroids 0.1ppm + Vermicompost 5t/ha + FYM 10t/ha were statistically on par with the treatment Brassinosteroids 0.1ppm + FYM 10t/ha.

Among Brassinosteroids 0.1ppm, Saicylic acid and NAAS highest grain yield is due to the application of Brassinosteroids 0.1ppm. (Sivakumar *et al.*, 2002)^[8]

Straw yield (t/ha)

Highest Straw yield (3.84 t/ha) was seen in the treatment Brassinosteroids 0.1ppm + FYM 10t/ha which was superior over rest of all treatments and the treatments with Brassinosteroids 0.1ppm + vermicompost 5t/ha and NAA 40ppm + FYM 10t/ha were statistically on par with the treatment Brassinosteroids 0.1ppm + FYM 10t/ha.

The use of bio-fertilizer (*Azotobacter* + PSB) along with FYM 2.5t/ha led to higher availability of N and P as well as promoted root growth, which is promoted yield attributes

characters. (Thumar *et al.*, 2016)^[9]

Harvest Index (%)

Highest Harvest index (41.79%) was seen in the treatment Brassinosteroids 0.1ppm + FYM 10t/ha which was superior over rest of all treatments with Brassinosteroids 0.1ppm + Vermicompost 5t/ha and NAA 40ppm + FYM 10t/ha were statistically on par with the treatment Brassinosteroids 0.1ppm + FYM 10t/ha.

Table 1: Effect of Growth regulators and Organic sources on growth attributes of Pearl millet

Treatments		Plant height (cm)	Tillers/m ²	Plant dry weight (g)
1.	Salicylic acid 100ppm + FYM 10t/ha	174.12	3.33	42.12
2.	Salicylic acid 100ppm + vermicompost 5t/ha	173.03	3.67	40.27
3.	Salicylic acid + poultry manure 3t/ha	172.34	3.33	36.36
4.	Brassinosteroids 0.1ppm + FYM 10t/ha	176.15	5.33	47.11
5.	Brassinosteroids 0.1ppm + vermicompost 5t/ha	175.83	5.00	46.22
6.	Brassinosteroids 0.1ppm + poultry manure 3t/ha	173.60	3.33	39.55
7.	NAA 40ppm + FYM 10t/ha	175.16	4.67	45.95
8.	NAA 40ppm + vermicompost 5t/ha	174.62	4.33	42.66
9.	NAA 40ppm + poultry manure 3t/ha	172.59	3.67	35.88
10.	Control	171.58	3.33	34.47
	F test	S	S	S
	S.Em (±)	0.18	0.32	0.74
	C.D (P=0.05)	0.53	0.72	2.21

Table 2: Effect of Growth regulators and organic sources on yield attributes and yield of Pearl millet

Treatments		No. of spikes/m ²	No. of Grains/spikes	Test weight (g)	Grain yield (t/ha)	Straw Yield (t/ha)	Harvest Index (%)
1.	Salicylic acid 100ppm + FYM 10t/ha	41.67	1870.00	11.02	2.56	3.71	40.76
2.	Salicylic acid 100ppm + vermicompost 5t/ha	40.00	1804.00	10.84	2.46	3.64	40.30
3.	Salicylic acid 100ppm + poultry manure 3t/ha	36.33	1662.67	10.60	2.39	3.46	40.83
4.	Brassinosteroids 0.1ppm + FYM 10t/ha	46.33	1992.67	11.48	2.76	3.84	41.79
5.	Brassinosteroids 0.1ppm + vermicompost 5t/ha	44.67	1963.67	11.38	2.67	3.82	41.13
6.	Brassinosteroids 0.1ppm + poultry manure 3t/ha	39.00	1850.67	10.97	2.49	3.68	40.34
7.	NAA 40ppm + FYM 10t/ha	43.67	1944.67	11.29	2.66	3.79	41.22
8.	NAA 40ppm + vermicompost 5t/ha	42.00	1928.67	11.16	2.60	3.77	40.83
9.	NAA 40ppm + poultry manure 3t/ha	37.67	1759.33	10.75	2.45	3.56	40.75
10.	Control	35.33	1629.67	9.84	1.91	3.37	36.16
	F test	S	S	S	S	S	S
	S.Em (±)	1.20	22.07	0.15	0.03	0.03	0.33
	C.D (P=0.05)	3.58	65.69	0.46	0.11	0.08	0.97

Conclusion

It is concluded that application of treatment Brassinosteroids 0.1ppm + FYM 10t/ha was recorded significantly higher grain yield (2.76 t/ha), higher gross returns (Rs.1,65,000.00/ha), net returns (Rs.1,20,510.00/ha) and benefit cost ratio (2.67) as compared to other treatments. Hence the treatment Brassinosteroids 0.1ppm + FYM 10t/ha is recommended for the Eastern U.P conditions.

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