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Influence of growth regulators (PGR) and organic manure on growth and yield of pearl millet (*Pennisetum glaucum* L.)

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Abstract

A field experiment was carried out at the Agricultural Research Farm of United University, Rawatpur, Jhalwa, Prayagraj (U.P.) in the *Kharif* season 2023 to investigate the Response of organic manure and growth regulators on growth and yield of Pearl Millet (*Pennisetum glaucum* L.) the study was performed in Randomized block design with three replications in ten treatments. The heterogeneous permissible combination with growth regulators + the organic substance of Farm yard manure + vermicompost + poultry manure + NPK (50% N). Significantly increased plant height (168.02 cm) at harvest, dry weight plant-1 (150.28 g), number of effective tillers plant-1 (6.03), Ear head length (24.04 cm), Number of grains/ear head (1988.30), Test weight (10.67 g), seed yield (3019.0 kg/ha) these results indicate that organic manure and adding growth regulators proved useful in achieving the yield.

Keywords: Pearl millet, NAA, poultry manure, NPK, yield and economics

Introduction

Pearl millet (*Pennisetum glaucum* L.) is the sixth most important cereal worldwide and the main food source in the semiarid regions of Asia and Africa. Globally, pearl millet is cultivated on 30 million ha with majority of the crop in Africa (~18 million ha) and Asia (>10 million ha) (Yadav and Rai 2013) ^[14]. It is mainly grown for food and forage in India and Africa, while as a forage crop in the Americas. India is the single largest producer of pearl millet (7.95 million ha, 8.90 Mt) with seven major growing states. Pearl millet is a C4 plant with very high photosynthetic efficiency, dry matter production capacity, short duration, and high degree of tolerance to heat and drought. It is also adapted on saline, acidic, and aluminum toxic soils (Yadav and Rai 2013) ^[14]. Major pearl millet production states in India are: Rajasthan, Maharashtra, Haryana, Uttar Pradesh and Gujarat. Bajracan also use as valuable animal fodder. India is the largest producer of pearl millet, the crop occupied an area of 14.72 million hectares, annual production of 16.14 million tones with an average productivity of 1311 kg/ha. In India major producing state are Rajasthan (46%), Maharashtra (19%), Gujarat (11%), Uttar Pradesh (8%) and Haryana (6%). (Source: Department of Food and Public Distribution 2017-18).

The plant growth regulators (PGRs) have potential for increasing crop productivity under environmental stress. PGRs are chemical substances, which can alter the growth and developmental processes leading to increased yield, improved grain quality or facilitated harvesting.

Seaweed extract is a new generation of natural organic fertilizers containing highly effective nutrition. The use of seaweed products are well known to improve seeds germination, seedlings development and increase plant tolerance to environmental stresses (Zhang and Ervin 2004) ^[15], and enhance plant growth and yield (Khan *et al.*, 2009; Craigie. 2011) ^[8, 11].

Panchagavya is a term used in Ayurveda fermented product made from five ingredients obtained from cow, such as milk, urine, dung, curd and clarified butter (Amalraj *et al.*, 2013). Role of foliar applied panchagavya in production of many plantation crops has been well documented in India (Selvaraj 2003) ^[12].

The application of organic manure improves soil fertility, organic matter content, water-holding capacity, nitrogen concentration, nutrient availability, absorption and mobilization while preventing soil erosion. Moreover, it enhances microbial activities and promotes the decomposition of polysaccharides and other organic compounds in the soil leading to increased crop leaf count (Adekiya *et al.*, 2020) ^[1].

Vermicompost also helps in reducing C:N ratio and in increasing humus content of the soil and provides a wide range of nutrients in readily available form to plants, such as nitrate, soluble phosphorus, exchangeable potassium, calcium, magnesium (Talashilkar *et al.*, 1999) ^[13].

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) ^[9].

Methods and Materials

The experiments was conducted during Kharif season of year 2022-2024. Was carried out at Agricultural Research farm of the Department of Agriculture Sciences & Technology, United University, Jhalwa, which is situated in district Prayagraj (U.P) – 211012. The field was well leveled having good soil condition. Geographically Rawatpur, Jhalwa, Prayagraj engages in subtropical climate and situated at 25.390 north latitude, 81.750 east longitude with an altitude of 113 meters above mean sea level. It is positioned about 6 km away from IIIT, Jhalwa.

The experiment was conducted in Randomized Block Design (RBD) of 10 treatment combined with 3 replications Each replication's arrangement of treatments was random. The treatments and layout specifications that were tested etc. The soil of the experimental field was silty clay loam having pH 8.25, electrical conductivity 0.40 dS m⁻¹, organic carbon 0.24% available-N 160.25 kg ha⁻¹, available-P₂O₅ 13.35 kg ha⁻¹, available-K₂O 245.63 kg ha⁻¹

Results and Discussion

Growth attributes Plant height

Significantly highest plant height (168.02 cm) was observed in the treatment with NAA 40 ppm + poultry manure (50% N) + NPK (50%) over all the other treatments. However, the treatments with application of NAA 40 ppm + FYM (50% N) + NPK (50% N) (159.04 cm) and NAA 40 ppm + vermicompost (50% N) + NPK (50% N) (131.70 cm) which were found to be at par with treatment NAA 40 ppm + poultry manure (50% N) + NPK (50%) as compared to all the treatments.

Plant dry weight (g/plant)

Treatment with NAA 40 ppm + poultry manure (50% N) + NPK (50%) was recorded with significantly maximum dry weight (150.28 g/plant) over all the treatments. However, the treatments with NAA 40 ppm + FYM (50% N) + NPK (50% N) (140.01 g/plant) and NAA 40 ppm + vermicompost (50% N) + NPK (50% N) (134.09 g/plant) which were found to be statistically at par NAA 40 ppm + poultry manure (50% N) + NPK (50%).

No of tillers Treatment with NAA 40 ppm + poultry manure (50% N) + NPK (50% N) was recorded with significantly

maximum no of tillers (6.03 tiller/plant) over all the treatments. However, the treatments with NAA 40 ppm + FYM (50% N) + NPK (50% N) (5.93 tiller/plant) and NAA 40 ppm + vermicompost (50% N) + NPK (50% N) (5.70 tiller/plant) which were found to be statistically at par NAA 40 ppm + poultry manure (50% N) + NPK (50%).

Yield parameter Numbers of ear head

A perusal data of the data clearly indicates that the number of ear head was significantly affected due to plant growth regulators and organic manure. Higher number of earhead with the value of (4.67) were recorded in T₄ (NAA 40 ppm + poultry manure (50% N) + NPK (50% N)). The smallest number of panicles was recorded in T₁₀ (RDF 100% control) (2.22).

Ear head length

A perusal data of the data clearly indicates that earhead length was significantly affected due to plant growth regulators and organic manure. Higher number of earhead length with the value of (24.04 cm) were recorded in T₄ (NAA 40 ppm + poultry manure (50% N) + NPK (50% N)). The smallest number of earhead length was recorded in T₁₀ (RDF 100% control) (14.45 cm).

No of grain per ear head

A perusal data of the data clearly indicates that no of grain per ear head was significantly affected due to plant growth regulators and organic manure. Higher number of grain per ear head with the value of (1988.30) were recorded in T₄ (NAA 40 ppm + poultry manure (50% N) + NPK (50% N)). The smallest number of ear head length was recorded in T₁₀ (RDF 100% control), (1455.18).

No of productive tillers/hill

An examination data of the data clearly indicates that no. of productive tillers/hill was significantly affected due to plant growth regulators and organic manure. Higher number of productive tillers/hills with the value of (4.55) were recorded in T₄ (NAA 40 ppm + poultry manure (50% N) + NPK (50% N)). The minimum number of ear head length was recorded in T₁₀ (RDF 100% control) (3.05).

Test weight (g)

Research of the data clearly indicates that Test weight (g) was significantly affected due to plant growth regulators and organic manure. Higher number of Test weight (g) with the value of (10.67g) were recorded in T₄ (NAA 40 ppm + poultry manure (50% N) + NPK (50% N)). The smallest number of ear head length was recorded in T₁₀ (RDF 100% control) (9.06g).

Seed yield (t/ha)

A perusal data of the data clearly indicates that seed yield was significantly affected due to plant growth regulators and organic manure. Highest seed yield with the value of (3019.0) were recorded in T₄ (NAA 40 ppm + poultry manure (50% N) + NPK (50% N)). The smallest number of ear head length was recorded in T₁₀ (RDF 100% control) (1918.0).

Table 1: Effect of plant growth regulators and organic manure to growth and yield attributes of Pearl millet

Tr. No.	Treatment combination	Growth Parameters			Yield Parameters	
		Plant height (cm)	No of tillers/plant	Plant dry weight (gm)	No. of ear head	Ear head length
T ₁	Panchgavya 2% + poultry manure (50% N) and NPK (50% N)	149.63	4.90	127.76	3.88	19.44
T ₂	Panchgavya 2% + FYM (50% N) and NPK (50% N)	145.10	4.67	125.77	3.87	18.18
T ₃	Panchgavya 2% + vermicompost (50% N) and NPK (50% N)	142.67	4.57	119.49	3.71	16.81
T ₄	NAA 40 ppm + poultry manure (50% N) and NPK (50% N)	168.02	6.03	150.28	4.67	24.04
T ₅	NAA 40 ppm + FYM (50% N) and NPK (50% N)	159.04	5.93	140.01	4.53	23.26
T ₆	NAA 40 ppm + vermicompost (50% N) and NPK (50% N)	158.85	5.70	134.09	4.42	21.30
T ₇	Sea weed 5% + poultry manure (50% N) and NPK (50% N)	151.52	5.47	131.35	4.49	20.67
T ₈	Sea weed 5% + FYM (50% N) and NPK (50% N)	151.41	5.40	131.09	4.31	19.86
T ₉	Sea weed 5% + vermicompost (50% N) and NPK (50% N)	151.49	5.30	130.12	3.94	19.55
T ₁₀	100% RDF (Control)	131.70	4.30	107.65	2.44	14.45
	F-test	S	S	S	S	S
	Sem±	5.29	0.18	6.00	0.20	1.23
	CD (p=0.05)	15.74	0.55	17.839	0.61	3.67

Table 2: Effect of plant growth regulators and organic manure to yield attributes of Pearl millet

Tr. No.	Treatment combination	Yield Parameters			
		No. of grain per ear head	No. of productive tillers/hill	Test weight (g)	Seed yield (t/ha)
T ₁	Panchgavya 2% + poultry manure (50% N) and NPK (50% N)	1683.24	3.75	9.03	2575.0
T ₂	Panchgavya 2% + FYM (50% N) and NPK (50% N)	1670.83	3.71	8.73	2482.7
T ₃	Panchgavya 2% + vermicompost (50% N) and NPK (50% N)	1639.70	3.18	8.58	2465.0
T ₄	NAA 40 ppm + poultry manure (50% N) and NPK (50% N)	1988.30	4.55	10.67	3019.0
T ₅	NAA 40 ppm + FYM (50% N) and NPK (50% N)	1889.18	4.19	10.59	2912.3
T ₆	NAA 40 ppm + vermicompost (50% N) and NPK (50% N)	1839.59	4.05	9.84	2862.3
T ₇	Sea weed 5% + poultry manure (50% N) and NPK (50% N)	1728.55	3.86	9.37	2782.0
T ₈	Sea weed 5% + FYM (50% N) and NPK (50% N)	1694.06	3.88	9.26	2691.7
T ₉	Sea weed 5% + vermicompost (50% N) and NPK (50% N)	1689.72	3.83	9.17	2623.7
T ₁₀	100% RDF (Control)	1455.18	3.05	9.06	1918.0
	F-test	S	S	S	S
	Sem±	87.54	0.21	0.42	138.29
	CD (p=0.05)	260.07	0.64	1.25	410.88

Summary and Conclusion

Among growth regulators and organic manure, application of NAA40ppm +poultry manure(50% N) + NPK (50% N) Di-ammonium phosphate (DAP) and muriate of potash full dose application at the time of sowing but nitrogen given two split doses before reproductive stages and FYM +Vermicompost applied at the time of sowing.

The result revealed that the application of T₄ (NAA 40 ppm + poultry manure(50% N) +NPK (50% N) recorded maximum plant height (168.02 cm.) number of tillers/ m² (6.03) dry matter accumulation (150.28 g) Ear head length (24.04 cm) Number of productive Ear head (4.67) Number of grains/ear head (1988.30) Test weight (10.67 g) Seed yield (3019.0 kg/ha) was recorded with the treatment of T₄ (NAA 40ppm + poultry manure (50% N) + NPK (50% N).

Based on one one-year experiment, it is the result summarized above, it may be concluded that the combined application of nutrients such as organic, inorganic and growth regulators had significant and positive effect on pearl millet. The result indicates that the productivity of pearl millet. Crop can be sustained by supplying growth regulator and organic manure recorded higher value at T₄(NAA 40 ppm + poultry manure(50% N) +NPK (50% N) total Net return (₹ 63339.4) since the data based on one year of study, further trail may be conducted to confirm the above findings.

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