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Potassium and plant growth regulators' influence on pearl millet (*Pennisetum glaucum* L.) Var. Jaigro 2828: Effects on growth parameters and yield

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Abstract
Background: Pearl millet is a suitable substitute for sorghum in areas where it cannot flourish since it can grow in a range of natural settings. Pearl millet outperforms maize and sorghum in terms of heat tolerance and soil moisture uptake.
Objectives: Effects of phosphorus and plant growth regulators on growth parameters and yield of pearl millet.
Methods: In order to investigate how phosphorus and plant growth regulators affect the development and yield of Pearl millet (*Pennisetum glaucum* L.) Var. Jaigro 2828, ten treatments (T1–T10) will be included in a randomized block design. The maximum plant height (227.00), plant dry weight (51.57) and yield parameters (ear head length (22.57cm), number of grains/ear head (1989), test weight (6.7g), grain yield (2.77 t/ha), and stover yield (3.80) were produced by phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm, according to the experimental results.
Conclusion: Farmers found that the most beneficial combination was Phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm; this produced plants with a height of 227 cm, a dry weight of 51.57 gm, 1989 grains per ear head, 6.7 g test weight, 2.77 ta grain yield, 3.80 ta stover yields, and a Harvest Index of 43.00%, respectively.

Keywords: Growth, pearl millet, phosphorus' plant growth regulators, yield

Introduction
Following rice, wheat, maize, and sorghum as the world's five most significant cereal crops, pearl millet (*Pennisetum glaucum*) comes in fifth. It may be grown in locations where rainfall is insufficient (200–600 mm/yr.) for the production of maize and sorghum. It is widely farmed as a rainfed cereal crop in the dry and semi-arid parts of Africa and Southern Asia (Venkata *et al*., 2001) [7]. In India, pearl millet is ranked fourth in terms of cereal crops, behind sorghum, rice, and wheat. When compared to other cereals, pearl millet may be an alternative crop with exceptionally valuable physiological traits because of its resistance to drought, low fertility, high salinity, and high temperature tolerance (Chaudhary *et al*., 2014) [5]. 6.93 million hectares are covered in pearl millet.

After nitrogen, phosphorus is the greatest restricting influence on crop growth and development. It is crucial for the metabolism of plant energy, photosynthesis, nitrogen fixation, nucleic acid synthesis, and enzyme control. Through its effects on root growth, blooming, and yield qualities, phosphorus promotes the growth of crops. Additionally, the poor solubility of P in soil limits its uptake. Phosphorus is a crucial element that is known as the "bottleneck of world hunger" since it is important to the growth and development of plants. Many aspects of plant growth development, such as flowering, fruiting, root growth, and yield components of many crops, are enhanced by adequate phosphorus nutrition. The extremely low solubility of P in the soil frequently limits the amount of P that plants can absorb.

Under environmental stress, plant growth regulators (PGRs) may be able to boost crop yield. Chemical compounds known as "growth regulators" have the ability to change how grains grow and develop, which can enhance grain quality, boost production, or make harvesting easier Espindula *et al*., 2009) [6].

(The growth characteristics of pearl millet were significantly influenced by nutrient levels and the use of plant growth regulators. the exogenous delivery of NAA to enhance yield and growth in a variety of stressful environments, including as severe heat, salt, drought, and heavy metal toxicity. Additionally, they participate in highly significant agronomic developmental processes such seed germination, leaf angle, blooming duration, and seed yield.

Materials and Methods

A field experiment was carried out at the C.R.F. of the wing of Agronomy in Shuats Prayagraj during the Zaid season of 2023. The location of the experiment is at 25o 24' 42" N latitude, 81o 50' 56" E longitude, and 98 m altitude above the mean sea level (MSL). to determine the effects of phosphorus and plant growth regulators on pearl millet (*Pennisetum glaucum* L.) growth and yield. Ten treatments that were duplicated three times made up the Randomized Block design used to set up the trial. Every plot has a length of 3 × 3 meters. The medication is categorized as having a recommended dose of potash via muriate of potash when administered in combination. as well as Nitrogen through Phosphorus and Urea via DAP. T1 – Phosphorus 30 kg/ha + NAA 50 ppm, T2 – Phosphorus 30 kg/ha + Triacontanol 250 ppm, T3 – Phosphorus 30 kg/ha + NAA 50 ppm + Triacontanol 250 ppm, T4 – Phosphorus 40 kg/ha + NAA 50 ppm, T5 – Phosphorus 40 kg/ha + Triacontanol 250 ppm,T6 – Phosphorus 40 kg/ha + NAA 50 ppm + Triacontanol 250 ppm, T7 – Phosphorus 50 kg/ha + NAA 50 ppm, T8 - Phosphorus 50 kg/ha + Triacontanol 250 ppm, T9 – Phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm T10 – Control. The pearl millet crop was carefully harvested when it reached harvesting maturity. One by one, five randomly chosen consultant plants from each replication's plot were measured for plant height (cm) and dry matter accumulation (g). After harvesting, seeds from each plot were separated and sun-dried for three days. The seeds were then cleaned and winnowed, and the yield of seeds per hectare was computed and reported in tonnes per hectare. The amount of spoilage produced by each plot was calculated and represented in tons per hectare following a thorough 15 days of sun drying. Utilizing, the statistics were computed and examined. The benefit: cost ratio was revised following the substitution of straw for grain as the fee value, and the overall value of Crop cultivation was safeguarded.

Details of treatment combinations

1. Phosphorus 30 kg/ha + NAA 50 ppm
2. Phosphorus 30 kg/ha + Triacontanol 250 ppm
3. Phosphorus 30 kg/ha + NAA 50 ppm + Triacontanol 250 ppm
4. Phosphorus 40 kg/ha + NAA 50 ppm
5. Phosphorus 40 kg/ha + Triacontanol 250 ppm
6. Phosphorus 40 kg/ha + NAA 50 ppm + Triacontanol 250 ppm
7. Phosphorus 50 kg/ha + NAA 50 ppm
8. Phosphorus 50 kg/ha + Triacontanol 250 ppm
9. Phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm
10. Control 80:40:40 N:P: K

Results and Discussion

Effect on Growth Parameters

Plant height

As crop growth continued, plant height increased, as Table 1 illustrates. For treatment T9 (Phosphorus 50 kg/ha + Plant height rose in tandem with crop growth, as Table 1 shows. The greatest height measured at harvest for treatment T9 (Phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm) was 227 cm. Treatments T8 outperformed treatments T9 statistically when the plant height of T9 was evaluated at harvest. Due to the constant nutrient supply during all growth phases and the positive link between phosphorus and plant growth regulators, treatment T9 produced the plants with the highest height. Taller plants are the outcome of nitrogen's influence on a plant's vegetative growth. The structural component and metabolically active material in cells known as plant growth regulator is most likely to blame for the appliance's increased plant height.

500 ppm or more of triacontanol (Mahmud *et al*., 2003) [9] NAA 100 ppm. Plant growth regulators (PGRs) may be able to increase crop productivity in stressful environmental conditions. "Growth regulators" are chemical substances that can alter the way grains develop and grow, improving grain quality, increasing output, or simplifying harvesting. (Sagar *et al*., 2020) [11].

Dry matter of plant

At harvesting, the maximum dry matter accumulation for treatments T9 (phosphorus 50 kg/ha + NAA 50 ppm + triacontanol 250 ppm) and T8 (48 kg K/ha) was 51.57 (g). Since dry matter accumulation is a characteristic of the other vegetative features, it is more significant. Pearl millet's dry weight increased significantly as phosphorus and plant growth regulators were added. Singh found that the dry matter output of the Pearl millet crop increased in tandem with rising K levels during the crop's growth cycle. Plant growth regulators (PGRs) have the potential to boost crop productivity in stressful environmental conditions. Growth regulators are chemical substances that alter the growth and development of plants to produce better-quality grains, increased yields, or simpler harvesting (Arshad *et al.*, (2016) [4].

Table 1: Effect of potassium and plant growth regulators on growth parameters of pearl millet at harvest

S. NO.	Treatments	Plant Height(cm)	Dry weight (g/plant)
1	Phosphorus 30 kg/ha + NAA 50 ppm	194.23	34.60
2	Phosphorus 30 kg/ha + Triacontanol 250 ppm	197.33	36.60
3	Phosphorus 30 kg/ha + NAA 50 ppm + Triacontanol 250 ppm	207.00	38.43
4	Phosphorus 40 kg/ha + NAA 50 ppm	211.00	40.57
5	Phosphorus 40 kg/ha + Triacontanol 250 ppm	215.00	42.53
6	Phosphorus 40 kg/ha + NAA 50 ppm + Triacontanol 250 ppm	218.00	44.53
7	Phosphorus 50 kg/ha + NAA 50 ppm	221.00	46.53
8	Phosphorus 50 kg/ha + Triacontanol 250 ppm	224.00	48.50
9	Phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm	227.00	51.57
10	Control 80:40:40 N:P: K	166.00	33.43
	F-test	S	S
	S.Em±	0.79	0.45
	CD (P = 0.05)	2.36	1.36

Yield and yield attributes

Ear head length

The significant influence of ear head period was demonstrated by the statistical study of ear head length. An important and maximal ear head length (22.57 cm) was the outcome of treating the area with Phosphorus 50 kg/ha, NAA 50 ppm, and Triacontanol 250 ppm. Nevertheless, no other treatment was able to attain statistical parity with phosphorus 50 kg/ha + NAA 50 ppm + triacontanol 250 ppm. A higher supply of phosphorus may lead to greater dry matter buildup, which is indicative of an overall improvement in plant development when phosphorus is applied. The outcomes resembled those of Reddy *et al.* (2022) [10], The use of triacontanol and NAA was linked to a higher rate of photosynthetic activity, faster transport, and more effective use of photosynthetic products, all of which led to cell elongation.and fast cell division in some parts of the plant. (Sivakumar *et al.*, (2020) [12].

Grain yield

The production of grains can be significantly impacted by various potassium and PGR combinations. The combination of phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm produced a grain yield of 2.77 ta/ha; however, the combination of phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm produced results that were statistically equal to those of phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm. Grain yields of pearl millet were significantly increased by applying higher doses of phosphorus and nitrogen. This implies that all growth indices and yield-related characteristics may have been improved by increasing the potassium supply. Grain yield is influenced by biological yield. Therefore, the improved grain production characteristics can be credited with a notable increase in biological yield. Additionally, these results align with those Sushila and Giri *et al.*, (2000) [14], Sivakumar *et al.*, (2002) [12].

Stover yield

The application of nitrogen and phosphorus had also significantly changed the pearl millet crop's stover yield output. The combination of phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm had the largest stover output (3.78 ta/ha); nonetheless, it was shown that this combination was statistically similar to phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm. Phosphorus and PGR were added, and pearl millet produced a significantly higher stover yield than it would without them. There may have been more photosynthesis, which led to an increase in plant growth and dry matter production. Thus, an increase in the supply of phosphorus may have enhanced all growth metrics and yield characteristics, ultimately leading to an increase in the output of stover. A straw crop's biological yield is impacted. Therefore, a significant increase in biological yields with the addition of phosphorus may be attributed to improved straw yield attributes. A greater supply of phosphorus may have led to improved growth parameters and yield-related characteristics, which in turn may have produced a higher stover yield. Nutrient levels were changed in order to enhance the stick output in Singh *et al.*, (2019) [13], (Adey *et al.*, (2022) [1].

Table 2: Effect of Phosphorus and plant growth regulators on Ear head length (cm), No of Grains/ear head (g) and Test weight(g), Stover Yield(t/ha) and harvest index (%) of pearl millet

S. No	Treatments	Ear head length (cm)	No of Grains/ear head	Stover yield (t/ha)	Harvest Index (%)
1	Phosphorus 30 kg/ha + NAA 50 ppm	15.40	1652.00	3.10	40.76
2	Phosphorus 30 kg/ha + Triacontanol 250 ppm	15.83	1685.00	3.17	41.37
3	Phosphorus 30 kg/ha + NAA 50 ppm + Triacontanol 250 ppm	16.53	1764.00	3.20	42.17
4	Phosphorus 40 kg/ha + NAA 50 ppm	17.50	1797.00	3.27	41.99
5	Phosphorus 40 kg/ha + Triacontanol 250 ppm	18.53	1826.00	3.47	41.58
a6	Phosphorus 40 kg/ha + NAA 50 ppm + Triacontanol 250 ppm	19.40	1847.00	3.53	42.07
7	Phosphorus 50 kg/ha + NAA 50 ppm	20.47	1906.00	3.57	42.16
8	Phosphorus 50 kg/ha + Triacontanol 250 ppm	21.43	1944.00	3.73	42.19
9	Phosphorus 50 kg/ha + NAA 50 ppm + Triacontanol 250 ppm	22.57	1989.00	3.80	43.00
10	Control 80:40:40 N:P: K	12.80	1523.00	3.07	39.05
	F-test	S	S	S	S
	S.Em±	0.29	2.76	0.04	0.58
	CD (P = 0.05)	0.86	8.21	0.13	1.72

Conclusion

It was determined that the maximum seed production (2.72 t/ha), gross return (1,36,000.00 INR/ha), net return (92,840.00 INR/ha), and B:C ratio (2.14) were achieved with the application of 60 kg K/ha + 100 ppm NAA/ha + 500 ppm Triacontanol/ha. Since these results are based on a single season, more research may be necessary to corroborate them.

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References

1. Adey Mourya, Shikha Singh. Effect of Bio-fertilizers and plant growth regulators on growth and yield of Pearl millet (*Pennisetum glaucum* L.). The Pharma Innovation Journal. 2022;11(4):1791-1794.
2. Anonymous. Area and production of pearl millet in India. Agricultural Statistics, Directorate of Economics & Statistics, Govt. of India; c2018-19.
3. Anonymous. Area and production of pearl millet in India. Agricultural Statistics, Directorate of Economics & Statistics, Govt. of India. 2019-20.
4. Arshad M, Adnan M, Ahmed S, Khan AK, Ali I, Ali M, *et al*. Integrated effect of phosphorus and zinc on wheat crop. Am-Eurasian J Agric Environ Sci. 2016;16(3):455-459.
5. Chaudhary NN, Khaif HR, Raj AD, Yadav V, Yadav P. Effect of nutrients (K and S) on growth, yield and

economics of pearl millet [*Pennisetum glaucum* (L.)]. Int J Forestry Crop Improv. 2014;5(1):9-12.

6. Espindula MC, Rocha VS, Grossi JAS, Souza MA, Souza LT, Favarato LF. Use of growth retardants in wheat. Planta Daninha. 2009;27:379-387.
7. Integrated nutrient management for dryland fodder sorghum (*Sorghum bicolor* L. Moench)- chickpea (*Cicer arietinum* L.) + coriander (*Coriander sativum* L.) cropping system. M.Sc. (Ag.) Thesis. Tamil Nadu Agricultural University, Coimbatore, India. 2001.
8. Jain NK, Dahama AK. Residual effect of phosphorus and zinc on yield, nutrient content and uptake and economics of pearlmillet (*Pennisetum glaucum*)-wheat (Triticum aestivum) cropping system. Indian J Agric Sci. 2005;75(5):281-284.
9. Mahmud K, Ahmad I, Ayyub M. Effect of Nitrogen and Phosphorus on the Fodder Yield and Quality of two Sorghum Cultivars (*Sorghum bicolor* L.). Int. J Agric Biol. 2003;263:61-63.
10. Reddy VSN, Singh R, Deepika CL. Effect of phosphorus and zinc on growth and yield of pearl millet (*Pennisetum glaucum* L.). The Pharma Innovation Journal. 2022;11(4):542-545.
11. Sagar MK, Ghilotia YK, Laxman PB, Indu BS. Effect of Plant Growth Regulators and Zinc Fertilization on Growth of Pearl millet (*Pennisetum glaucum* L.). Int. J Curr Microbiol Appl Sci. 2020;9(12):3161-3168.
12. Sivakumar R, Pathmanaban G, Kalarani MK, Mallika V, Srinivasan PS. Effect of Foliar application of Growth regulators on Biochemical attributes grain yield in Pearl millet. Indian J Plant Physiol. 2002;7(1):79-82.
13. Singh S, Singh V, Shukla RD, Yadav B. Effect of planting geometry and phosphorus levels on pearl millet (*Pennisetum glaucum*). An Int. J. 2019;14(1):18-22.
14. Sushila R, Giri G. Influence of farmyard manure, nitrogen and biofertilizers on growth, yield attributes and yield of wheat (*Triticum aestivum*) under limited water supply. Indian J Agronomy. 2000;45(3):590-595.