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Influence of Pottasium and Plant Growth Regulators on Growth and Yield of Pearlmillet (*Pennisetum glaucum* (L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Background: Pearl millet [*Pennisetum glaucum* (L.) is a significant food and livestock crop in the semi-arid tropics. Pearl millet is a crucial part of the nation's food security because of its capacity to thrive in drier and less fertile regions, where other grains have a comparative disadvantage.
Objectives: Effect of potassium and plant growth regulators on growth parameters and yield of pearl millet
Methods: With the goal of the study effect of potassium and plant growth regulators on growth and yield of Pearl millet (*Pennisetum glaucum* L.) Var. NBH- 5658 under a Randomized block design(RBD) with 10 treatments (T1-T10) The experiment's findings showed that a potassium

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concentration of 60 kg/ha combined with an NAA concentration of 100 ppm and a triacontanol concentration of 500 ppm led to the highest plant height (221.20 cm), dry weight (49.42 cm), and yield parameters for ear head length (20.50 cm), number of grains per ear head (1970), Test weight (9.38 g), grain yield (2.72 t/ha), and stover yield (3.78 t/ha).

Conclusion: Farmers found that using potassium at a rate of 60 kg/ha in conjunction with NAA at a concentration of 100 ppm and Triacontanol at a concentration of 500 ppm produced the best results, with plant dimensions of (221.20 cm) in height, (49.42 gm) in plant dry weight, (1972) grains per ear head, (9.38 g) test weight, (2.68 ta/ha) in grain yield, and (3.26 ta/ha) in stover yields, respectively.

Keywords: Growth; pearl millet; potassium' Plant growth regulators; NAA; triacontanol; yield.

1. INTRODUCTION

Pearl millet [*Pennisetum glaucum* (L.)] is a cereal crop, after rice, wheat, maize, and sorghum, that is essential. On 30 million acres of land in the tropical dry and semi-arid region of Asia and Africa, it is a staple meal for 90 million poor people and accounts for half of the world's millet output. After rice, wheat, and maize, the fourth most grown crop in India. Several rural communities utilise the bajra crop as a feed grain for their cows and for thatching rooftops. Most bajra is grown in dry, arid regions [1]. a cereal crop, after rice, wheat, maize, and sorghum, that is essential. On 30 million acres of land in the tropical dry and semi-arid region of Asia and Africa, it is a staple meal for 90 million poor people and accounts for half of the world's millet output. After rice, wheat, and maize, teh fourth most grown crop in India. Several rural communities utilise the bajra crop as a feed grain for their cows and for thatching rooftops. Most bajra is grown in dry, arid regions [2].

Protein (11.6%), iron in particular (8.8%), fat (5%) and carbs (67%) are all abundant in its grains. Most of the world's pearl millet is cultivated in North West India, which also produces 24% of the world's coarse grains and covers 42% of the total area under pearl millet cultivation (Anonymous, 2013-14). Concerns regarding agriculture's capacity to meet the demands of a population that is expanding at an exponential rate have increased due to a lack of new land available for food cultivation and deteriorating soil fertility. When compared to solitary cropping, intercropping increases overall production per unit area per unit time by making efficient use of resources. Planting short-lived crops like pearl millet alongside cluster beans and green gramme crops may increase economic returns per unit of land since there will be less rivalry due to their temporally varying peak resource demand. (Bishan Rawat et al. 2018).

A vital main nutrient for plants, potassium serves a variety of purposes. During the grain filling process, potassium turns sugar into starch and improves water usage efficiency. As a result of its crucial role in controlling stomatal function and the activation of enzymes, potash is frequently depleted in soils when long-term continuous cropping is practised without the addition of additional potash, leaving little exchangeable potassium. In order to complete its life cycle, millet, one of the crops with a high potassium need, needs a significant amount of potassium. The main source for supplying soil with K in the absence of external potassium administration is weathering of the soil [3].

Under environmental stress, plant growth regulators (PGRs) have the potential to boost crop yield. Chemicals known as "growth regulators" can change how organisms grow and develop, which might enhance output, improve grain quality, or make harvesting easier [4]. The amount of nutrients and the use of plant growth regulators had a big impact on Pearl millet's growth metrics. the exogenous use of NAA to boost yield and growth in the face of diverse stresses as salt, drought, extremely high or low temperatures, and heavy metal toxicity. Also, they participate in very significant agronomic developmental processes such seed germination, leaf angle, blooming duration, and seed yield.

2. MATERIALS AND METHODS

During the Zaid season of 2022, a field experiment was conducted out at the C.R.F of the wing of Agronomy in Shaits Prayagraj, which is located at 25o 24' 42" N latitude, 81o 50' 56" E longitude, and 98 m altitude over the mean sea degree (MSL). to see How Pearl millet's growth and productivity are affected by potassium and plant growth regulators (*Pennisetum glaucum* L.). Ten treatments, each replicated three times, were used in the experiment, which was set up using a randomised block design. The size of each plot is 3 metres. The suggested doses for the medication include potassium through, nitrogen via urea, and phosphorus via DAP. , Potassium via Muriate of Potash. (T1) Potassium 40 kg /ha + NAA 100 ppm (T2) Potassium 40 kg /ha +Triacontanol 500 ppm, (T3) Potassium 40 kg /ha + NAA 100 ppm + Triacontanol 500 ppm, (T4) Potassium 50 kg /ha + NAA 100 ppm, (T5) Potassium 50 kg /ha + Triacontanol 500 ppm, (T6) Potassium 50 kg /ha + NAA 100 ppm + Triacontanol 500 ppm, (T7) Potassium 60 kg /ha + NAA 100 ppm, (T8) Potassium 60 kg /ha + Triacontanol 500 ppm, Treatment (T9) Potassium 60 kg /ha + NAA 100 ppm + Triacontanol 500 ppm (T10) N-P-K (RDF 80;40;40) /ha. The Stover production from each online plot was measured and expressed in tonnes per hectare after 10 days of full drying in the sun. Using, the statistics were computed and examined. the Gomez and Gomez [5] statistical approach.

3. RESULTS AND DISSCUSIONS

3.1 Effect on Growth Parameters

3.1.1 Plant height

The application of potassium 60 kg/ha + NAA 100 ppm + triacontanol 500 ppm resulted in the highest plant height (221.20 cm), and it was noticeably better than all other treatments. The manufacture of phytohormones, which potassium affects, plays a critical role in meristematic development. Cytokinin, among other plant hormones, is necessary for plant growth. This is the most likely explanation for the increased plant height. Similar outcomes were noted by Chauhan et al. [6]. Chemicals known as "growth regulators" can change how organisms grow and develop, which might enhance output, improve grain quality, or make harvesting easier [7].

Fig. 1. Field sampling

3.1.2 Dry matter of plant

The application of potassium (K) 60 kg ha-1 + NAA 100 ppm + Traicontonol 500 ppm resulted in the maximum dry weight (49.42 g/plant). The potassium in this application, which plays a critical role in meristematic development through its impact on the production of phytohormones, may be the likely cause of the rise in dry weight. comparable outcomes reported by Chauhan et al. [6]. Improvement in dry matter accumulation by PGRs has been ascribed to a decrease in photorespiration, and it is well known that the balance between photosynthesis and respiration processes in a plant system determines how much dry matter accumulates. Increased chlorophyll production in leaf tissue and postponed leaf senescence might both contribute to an increase in plant growth. Also, it is likely that photosynthetic efficiency may have persisted for longer after the foliar application of growth regulators due in part to treated plants' faster rate of CO_2 fixation and in part to photosynthates' reported increased translocation from source to different sinks [8].

3.2 Yield and Yield Attributes

3.2.1 Ear head length

A substantial and maximum ear head length of 20.50 cm was measured after treatment with potassium (K) 60 kg ha + NAA 100 ppm + tracconol 500 ppm. Using more potassium causes plants to produce more cytokines, which stimulates cell growth and division. Increased potassium fertilisation enhanced crop ear head length as a result of increased photosynthates production since potassium is a component of chloroplast porphyrins. Treatment with plant growth regulators will be linked to an overall improvement in plant growth as indicated by a rise in dry count number accumulation, which may result from more rapid nutrient supply to plants. It's possible that greater food availability to plants during the flower primordial initiation stage helped to produce more sturdy tillers and, as a result, longer ear heads. These results are in line with those of Azad et al. [9], Sharma et al. [10].

3.2.2 Number of grains

The treatment with the highest number of grains per ear head was potassium 60 kg/ha plus NAA 100 ppm plus triacontanol 500 ppm. The enhanced activity of cytokinin, which is stimulated by nitrogen in plants, promotes cell division and elongation. Since porphyrins in chloroplasts contain potassium, increased potassium fertilisation increased photosynthate synthesis, which in turn increased grain and ear head production. Munirathnam and Gautam, and Reddy et al. [11,12], have discovered that depending on the amount of nutrients in the soil, the number of grains per ear head may change. The general improvement in plant development can be attributed to the greater use of plant growth regulators and other nutrient sources to plants. Plants may have benefited from an earlier delivery of nutrients during the floral primordial initiation stage, resulting in a higher number of functional tillers and eventually more grains/ear heads. found similar outcomes Gurrala et al. [13].

Fig. 2. Biological yield

Table 1. Effect of potassium and plant growth regulators on growth parameters of pearl millet

T No.	Treatments	Plant Height(cm)	Dry weight (g)
1	Potassium 40 kg/ha + NAA 100 ppm	198.07	33.56
2	Potassium 40 kg/ha + Triacontanol 500 ppm	212.00	35.24
3	Potassium 40 kg/ha + NAA 100 ppm + Triacontanol 500 ppm	214.27	37.37
4	Potassium 50 kg/ha + NAA 100 ppm	215.73	39.73
5	Potassium 50 kg/ha + Triacontanol 500 ppm	216.80	41.75
6	Potassium 50 kg/ha + NAA 100 ppm + Triacontanol 500 ppm	217.13	42.69
7	Potassium 60 kg/ha + NAA 100 ppm	217.20	44.85
8	Potassium 60 kg/ha + Triacontanol 500 ppm	220.07	47.09
9	Potassium 60 kg/ha + NAA 100 ppm + Triacontanol 500 ppm	221.20	49.42
10	Control 80:40:40 N:P:K	192.80	32.57
	F test	S	S
	SEm±	0.47	0.47
	CD (P = 0.05)	1.26	0.35

Table 2. Potasium and plant growth Regulators influence on Cumbu Yield

T No.	Treatments	Ear head Length(cm)	No. of grains/ear head	Grain Yield (ta/ha))	Stover Yield (ta/ha)
1	Potassium 40 kg/ha + NAA 100 ppm	16.15	1621.00	2.33	3.25
2	Potassium 40 kg/ha + Triacontanol 500 ppm	16.75	1681.00	2.18	3.44
3	Potassium 40 kg/ha + NAA 100 ppm + Triacontanol 500 ppm	17.53	1759.00	2.24	3.37
4	Potassium 50 kg/ha + NAA 100 ppm	17.07	1783.00	2.40	3.58
5	Potassium 50 kg/ha + Triacontanol 500 ppm	18.30	1856.00	2.56	3.67
6	Potassium 50 kg/ha + NAA 100 ppm + Triacontanol 500 ppm	19.50	1868.00	2.42	3.64
7	Potassium 60 kg/ha + NAA 100 ppm	18.20	1945.00	2.67	3.72
8	Potassium 60 kg/ha + Triacontanol 500 ppm	20.40	1964.00	2.69	3.74
9	Potassium 60 kg/ha + NAA 100 ppm + Triacontanol 500 ppm	20.50	1970.00	2.72	3.78
10	Control 80:40:40 N:P:K	15.91	1521. .00	2.20	3.15
	F test	S	S	S	S
	SEm±	0.06	5.16	8.35	6.81
	CD (P = 0.05)	0.19	15.34	0.02	0.11

Fig. 3. Stover yield

3.2.3 Grain yield

With a treatment of Potassium 60 kg/ha + NAA 100 ppm + Triacontanol 500 ppm, a grain yield of 20.50 ta/ha was attained. Increased potassium and plant growth regulator applications significantly increased pearl millet grain yields. The superior grain production traits can thus be credited with a large increase in biological yield. These results are in line with those of Heidari et al. [14-17].

4. CONCLUSION

It was concluded Potassium 60 kg/ha + NAA 100 ppm +Triacontanol 500 ppm was Plant height of 221.20 cm, plant dry weight of 49.42 gm, grains per ear head of 1970, grain production of 2.72 ta/ha, and stover yield were found to be the most advantageous for farmers. 3.15 ta/ha. These findings are Based on one season. There for. For the trails may be required for farther confirmation.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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