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Full Length Research Paper

Impact of Auxin and Gibberellin on the Growth Dynamics of Pearl Millet (*Pennisetum Glaucum* L.)

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ARTICLE DETAILS

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ABSTRACT

Millets are the super food, Millets are known for their nutritional value, as they are rich in protein, fiber, vitamins, and minerals such as iron, magnesium, and phosphorus. Millets are nutrient dense and the scientific studies have shown that the millets reduce the Iron deficiency, risk of type II diabetes, BMI and obesity, calcium deficiency. Two growth hormones auxin [IAA] and gibberellin [GA] were used individually and in combinations. Due to the varying concentration of treatments of growth hormone plant alters physiological process which results in the change in the morphological structure in the plants such as increase in plant height, plant girth, chlorophyll content, photo-morphogenesis and photo-tropism.

1. Introduction

Millets are a group of small-seeded grasses that are cultivated as food crops around the world. Millets are known for their nutritional value, as they are rich in protein, fiber, vitamins and minerals such as iron, magnesium, and phosphorus. Millets are nutrient dense the scientific studies have shown that the millets reduce the Iron deficiency, risk of type II diabetes, BMI and obesity, calcium deficiency. Millets are more resilient to drought and other extreme weather conditions, making them an important crop option in areas prone to climate change-induced droughts and water scarcity (Chaudhary et al., 2023). Pearl millet (*Pennisetum glaucum*) is the most widely grown type of millet. Because of its tolerance to difficult growing conditions such as drought, low soil fertility and high temperature, it can be grown in areas where other cereal crops, such as maize (*Zea mays*) or wheat (*Triticum aestivum*), would not survive.

Growth regulators are organic substances besides nutrients, synthesized in plants, causing alteration in their cellular metabolism. Synthesis of some plant hormones is adversely affected by environmental factors, which causes restriction on physiological processes of the plant and ultimately, limits their growth potential (Copur et al., 2010). The application of these hormones in low concentration regulates growth, differentiation and development, either by promotion or inhibition (Naem et al., 2004), and allows physiological processes to occur at their normal rate (Gulluoglu, 2004). Major plant growth regulators (PGRs) significantly enhanced fiber yield in cotton (Copur et al., 2010), protein content in pea (Bora and Sarma, 2006), chemical constituents in *Croton* (Soad et al., 2010), fruit size in *Molina* (Vwioko and Longe, 2009), seed germination rate in black gram and horse gram (Chauhan et al., 2009), floral buds in *Jojoba* (Prat et al., 2008) and other growth parameters in different plants.

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2. Material and Methods

An experiment was designed by choosing “Parbhani Sampada”, a high yielding variety of pearl millet (*Pennisetum glaucum* L.). The seeds were sown in 10 trays of equal size (10cm× 8cm× 2.5 cm) of varying concentration of growth hormones, each tray consisting of 3 rows. Two growth hormones auxin [IAA] and gibberellin [GA] were used individually and in combinations. Initial dose of different concentrations of IAA, GA and combination of IAA+GA was given to the designated trays. The first spray was applied after one week of sowing, followed by the second and third, after an interval of 7 days, respectively. Similar hormonal treatments at similar time intervals were applied to plants.

2.1 Measuring the shoot and root length:-

- After 30 days of sowing and accomplishing complete treatment of hormones, plants were extracted from the soil.
- The roots were isolated from soil core and then roots separated from the surrounding soil over a sieve by hand (Prathapar et al., 1989).
- The length of total plant and distinct length of shoot and root were measured precisely on graph paper.
- Record the length of shoot and root of each concentration.
- Calculate the mean of length of shoot and root of each concentration.
- Compare it with control as well as among them.



Fig. 1: Picture of plants after one week of second treatment.

2.2 Evaluation of total dry weight of shoot and root:-

- Separate the root and shoot of each plant by cutting it with the help of aseptic blade.
- Weigh it on weighing balance. This weight is known as fresh weight of shoot and root.
- Keep it in hot air oven for 60° Cover night.
- Record the total weight of shoot and root. This weight is known as total dry weight of shoot and root.
- Compare the total dry weight of shoot and root with control as well as among them.
- By comparing the total dry weight of shoot and root with fresh weight of shoot and root, moisture content can be evaluated.

3. Observation and Results

Table 1: Showing shoots height and root height

Sr. No.	Treatments	Shoot height(cm)	Root height(cm)
1.	Control	20.37cm	13.59cm
2.	IAA0.5mgL ⁻¹	28.23cm	15.36cm
3.	IAA1mgL ⁻¹	34.67cm	16.89cm
4.	IAA2mgL ⁻¹	32.53cm	16.14cm
5.	GA200ppm	21.67cm	13.72cm
6.	GA400ppm	24.37cm	16.14cm
7.	GA600ppm	27.24cm	22.29cm
8.	IAA0.5mg+GA200ppm	22.54cm	17.52cm
9.	IAA1mg+GA400ppm	21.77cm	16.24cm
10.	IAA2mg+GA600ppm	20.93cm	13.82cm

The mean values of shoot height ranged from 20.37 cm to 34.67 cm and mean value of root height ranged from 13.59 cm to 22.29 cm. After each application of growth hormones, plant height increased considerably in relation to the control plants. General increased in plant height was maximized after third application of growth hormones. However, the doses which had the highest fold enhancement in the particular treatment were considered effective dose, and on this basis, IAA at 1 mg L⁻¹ was

found efficient for plant height.

Table 2: Showing total dry weight of shoot and root

Sr. No.	Treatments	Fresh weight(g)		Total dryweight(g)	
		Shoot	Root	Shoot	Root
1.	Control	6.82	2.35	1.13	1.02
2.	IAA0.5mgL ⁻¹	6.79	4.58	2.87	2.98
3.	IAA1mgL ⁻¹	7.22	2.94	2.88	1.94
4.	IAA2mgL ⁻¹	6.15	2.89	2.97	1.77
5.	GA200ppm	7.85	2.72	1.75	1.77
6.	GA400ppm	6.51	2.88	1.66	1.62
7.	GA600ppm	6.39	2.38	1.88	1.14
8.	IAA0.5mg+GA200ppm	6.66	2.6	1.67	1.98
9.	IAA1mg+GA400ppm	7.54	1.98	1.59	1.02
10.	IAA2mg+GA600ppm	6.22	3.43	1.56	1.57

Fresh weight of plants consists of water content, carbon containing compounds and nutrients but dry weight of plant consists of just carbon containing compounds and nutrients. The mean of total dry weight of shoot ranged from 1.13 g to 2.41 g and that of root ranged between 1.02 g to 2.98 g. The mean value showed that IAA alone at all the concentrations increased dry weight effectively. Among three doses of IAA, dry weight was significantly enhanced at the dose of 2 mg L⁻¹ (2.97 g), followed by 1 mg L⁻¹ (2.88 g) and 0.5mgL⁻¹ (2.87g). The lowest weight was registered in the combine dose auxin 2mg+ gibberellins 600ppm (1.56g) although it was higher than control (1.13g).

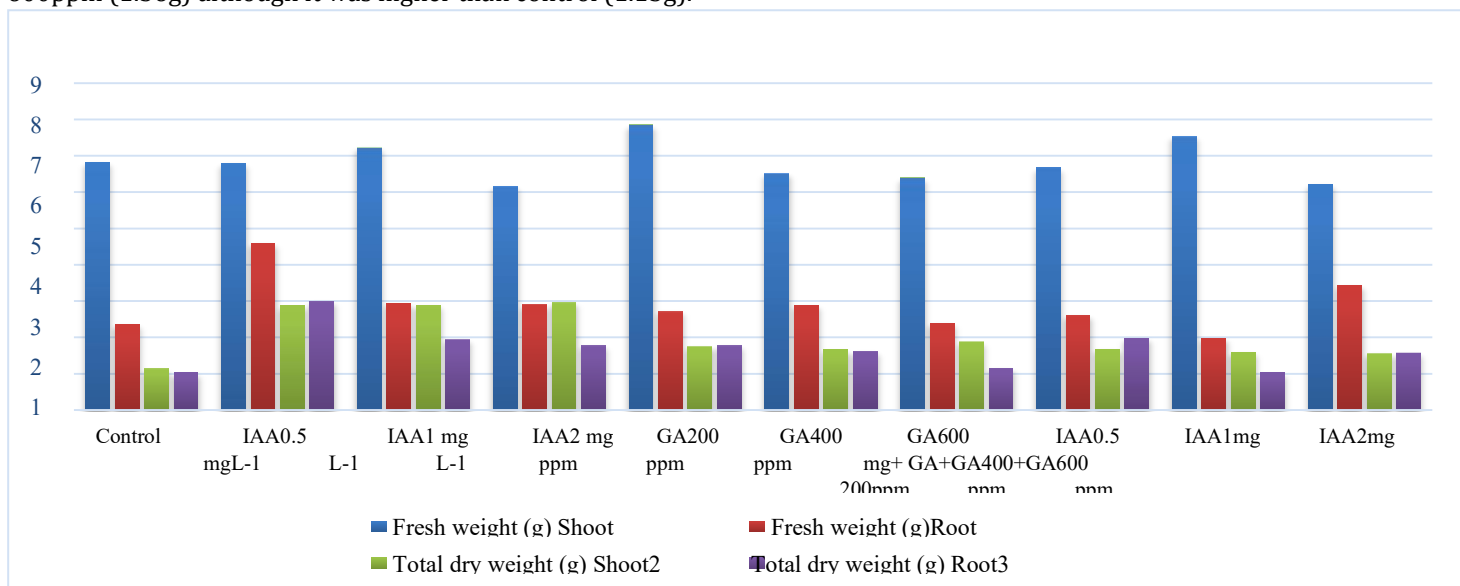


Fig. 2: Graph representing total dry weight of shoots and root

4. Conclusion

From the above result it was concluded that apparent association seems to exist between growth hormones and growth parameters in pearl millet. Mean values of different traits showed that cultivar "Parbhani Sampada" responded positively to both growth hormones (IAA and GA). The doses of growth hormones enhanced the plant height (shoot as well as root), chlorophyll content (chlorophyll a, chlorophyll b, total chlorophyll content). Among various doses of growth hormones IAA alone was found to be more effective in plant height and chlorophyll content.

Among the ten treatments auxin alone was found to be more efficient growth hormone among the other concentrations of hormones. IAA 1 mg L⁻¹, followed by IAA 2mg L⁻¹ and IAA 0.5 mg L⁻¹ found more effective among other concentrations such as 200ppm GA, 400 ppm GA, 600 ppm GA and combined dose of 0.5 mg L⁻¹ IAA + 200 ppm GA, 1 mg L⁻¹ IAA + 400 ppm GA and 2 mg L⁻¹ IAA + 600 ppm GA. 600 ppm GA was found more effective for increasing girth of plant along with 1 mg L⁻¹ IAA + 400 ppm GA. Due to the varying concentration of treatments of growth hormone plant alters physiological process which results in the change in the morphological structure in the plants such as increase in plant height, plant girth, chlorophyll content, photo-morphogenesis and photo-tropism.

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