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Effect of Plant Growth Regulators on Growth of Petunia (*Petunia hybrida* L.) var. Grandiflora Rose

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The present investigation was conducted at the Experimental Farm, Department of Agriculture, Mata Gujri College, Fatehgarh Sahib, Punjab in 2023 with ten treatments comprising of T_1; Control, T_2; GA_3 (250 ppm), T_3; GA_3 (350 ppm), T_4; GA_3 (450 ppm). T_5; CCC (450 ppm), T_6; CCC (550 ppm), T_7; CCC (650 ppm), T_8; NAA (40 ppm), T_9; NAA (50 ppm) and T_{10}; NAA (60 ppm) with three replications in randomized block design. The results revealed the maximum plant height (27.94 cm), plant spread (57.02 cm^2), number of leaves/plant (651.04), number of branches/plant (21.96), Stem length (25.63), Leaf area (9.07 cm^2) were in T_3; GA_3 at a rate of 350 ppm, while minimum plant height (19.05 cm) and Stem length (16.12 cm) was recorded in T_6; CCC at a rate of 550 ppm and rest of the vegetative parameters was in T_1; Control.

Keywords: CCC; GA3; NAA; petunia; plant growth regulators.

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1. INTRODUCTION

One of the most significant annual flowers, the petunia (*Petunia* × *hybrida*) belongs to the Solanaceae family. The petunia originated in South America. Petunia genus, which includes over 25 species of various kinds, including synthetic garden plant species, is one of the most widely utilized genera for the production of new variants. It has been a commercially significant annual flower. The research on petunia shown that there are currently only 14 species recognized in the genus Petunia [1]. Through a natural cross between two wild species, *Petunia axillaris* Lam. and P. *violacea* Lindl the most popular petunia, *Petunia* × *hybrida*, emerged. It has outstanding aesthetic value [2].

The foliar application of plant growth regulators offers an efficient means of directly delivering specific growth regulators to plant tissues, by passing the root system. This technique is frequently utilized to target particular plant responses, such as the promotion of flowering, the enhancement of leaf growth, and the improvement of stress tolerance.Following the recommended application rates and timings is imperative when using foliar-applied PGRs to achieve optimal results and prevent potential phytotoxicity concerns. Properly diluting the PGR solution and ensuring uniform leaf coverage are critical for effective absorption and translocation within the plant

Many ornamental crops have utilized various plant growth regulators with their effectiveness proven in nursery production, ornamental foliage plants, and other flower crops. Keep in mind the importace of Petunia and growth regulators, the present investigation was conducted with the aim to evaluate the effect of growth regulators on Petunia.

2. MATERIALS AND METHODS

The study comprises of ten treatments with specific concentrations T_1; Control, T_2; GA_3 (250 ppm), T_3; GA_3 350 ppm), T_4; GA_3 (450 ppm), T_5; CCC (450 ppm), T_6; CCC (550 ppm), T_7; CCC (650 ppm), T_8; NAA (40 ppm), T_9; NAA (50 ppm), T_{10}; NAA (60 ppm). Seedlings of Petunia var. Grandiflora rose was planted in a randomized block design with three replications at the experimental farm, Department of Agriculture, Mata Gujri College, Fatehgarh Sahib, Punjab, during the winter season of 2023. The plant spacing was maintained at 30 × 25 cm, and all the recommended practices were followed to ensure healthy growth of the plants.

We measured some growth parameters such as plant height, number of branches, plant spread, number of leaves, stem length, and leaf area.

Plant growth regulators were applied using the foliar method because of the quick response of growth regulators. It involves the direct spraying of growth regulators onto the plant. It was done 30 days post-transplanting. For foliar spray, solutions of GA_3 at rates of 250, 350, and 450 ppm, NAA at rates of 40, 50, and 60 ppm, and CCC at rates of 450, 550, and 650 ppm were prepared.

3. RESULTS AND DISCUSSION

3.1 Vegetative Parameters

All the vegetative treatments showed a significant ($P<0.05$) effect on all the six parameters of growth. The tallest plants were noted in T_3 which exhibited statistical superiority compared to the other treatments. The shortest plants were noted in T_6 which is statistically inferior to other treatments. The application of the optimum dose of the GA_3 might have increased the plant height through the acceleration of cell division, cell elongation, stem elongation and internodal distance which helped the plants to grow taller. The findings of the present research are consistent with the results of Sharma and Collis [3] Surabhi et. al*.,* [4] Alhajhoj [5] and Manimaran et. al*.,* [6].

Treatment T_3 displayed the highest ($P<0.05$) number of branches demonstrating statistical superiority over the other treatments. The lowest number of branches was found in T_1 excluding the application of plant growth regulators which is statistically inferior to other treatments. The optimum dose of GA_3 (350 ppm) enhances the cell growth which encourages the formation of more branches. The observations and findings in the present investigation are consistent with the results obtained by Delvadia et. al*,* [7] and Shinde et. al*.,* [8].

T_3 resulted in the plant achieving its maximum spread, which is statistically at par with T_2, T_4. The minimum plant spread was found in T_1 which is statistically at par with T_6, T_9, T_5 and T_7 .The increased spread of plants was due to the application of GA_3 which is responsible for the promotion of cell elongation and division, ultimately leading to comprehensive plant growth and development. Similar results were also noted by Guatam et. al*.,* [9] and Kumar et. al*.,* [10].

Table 1. Performance of different treatments for various characters of Petunia

Treatment	Plant height (cm)	Number of leaves/plant	Plant spread (cm^2)	Number of branches/plant	Stem length (cm)	Leaf area (cm^2)
T_1	19.42	315.73	44.60	14.64	17.31	7.19
T_2	25.66	632.66	56.63	19.13	23.34	7.73
T_3	27.94	651.04	57.02	21.96	25.63	9.07
T_4	23.79	605.93	51.19	17.53	21.48	7.57
T_5	19.40	607.53	50.52	16.69	16.63	7.41
T_6	19.05	462.44	50.17	17.20	16.12	7.62
T_7	20.80	632.61	50.61	17.22	18.62	7.61
T_8	17.99	369.87	50.88	17.09	17.28	7.45
T_9	22.00	639.08	50.17	17.31	19.81	7.59
T_{10}	20.65	476.57	50.84	17.20	18.44	7.42
Sem±	0.28	20.80	2.03	0.34	0.37	0.06
$CD_{0.05}$	0.84	61.79	6.03	1.01	1.10	0.18

T_1; Control, T_2; GA_3 (250 ppm), T_3; GA_3 (350 ppm), T_4; GA_3 (450 ppm), T_5; CCC (450 ppm), T_6; CCC (550 ppm), T_7; CCC (650 ppm), T_8; NAA (40 ppm), T_9; NAA (50 ppm), and T_{10}; NAA (60 ppm).

The highest (P<0.05) number of leaves was seen in the T_3 which is statistically at par with T_9, T_2, T_7, T_5, T_4. T_{10} and T_6; CCC (550 ppm) (462.44). At optimum concentration of GA_3, it will accelerate plant growth and improve the uptake of nutrients which leads to more number of leaves per plant. The shortest number of leaves was seen in T_1; control (315.73) which is statistically at par with T_8; NAA (40 ppm) (369.87). The studies were conducted by Kumar et. al*.,* [11] and Sharma and Joshi [12].

The T_3 exhibited the longest (P<0.05) stem length which is statistically superior to the other treatments. The stem length was increased due to the application of GA_3 to the plants, a significant (P>0.05) increase in stem length can be observed due to the activation of cell elongation processes. The shortest stem length was found in T_6 which is statistically inferior to other treatments. These results are similar to Tyagi and Kumar [13] and Dhaduk et. al*.,* [14].

Treatment T_3 exhibited the greatest (P<0.05) leaf area compared to the other treatments, demonstrating statistical superiority. The minimum leaf area was found in T_1 which is statistically inferior to other than treatments. The rise in leaf area as a result of foliar GA_3 spray can be attributed to the stimulation of increased cell division and elongation. The outcomes of the present investigation are consistent with the studies carried out by Shrinivasa [15] and Chandrappa et. al*.,* [16].

4. CONCLUSION

GA_3 at a rate of 350 ppm performed best in various vegetative parameters plant height (27.94 cm), number of branches per plant (21.96), plant spread (57.02 cm^2), number of leaves per plant (651.04), stem length (25.63 cm) and leaf area (9.07 cm^2).

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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