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The Influence of Auxins on the Rooting Process of Terminal Cuttings of Chrysanthemum (*Dendranthema grandiflora*)

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ABSTRACT: The research was conducted at the polyhouse in the Department of Horticulture, Agriculture College, Bapatla. A Completely Randomized Design (CRD) with 13 treatments, each replicated three times, was used. The effects of different auxins at various concentrations varied significantly among the treatments. Terminal cuttings of Chrysanthemum treated with IBA at 250 ppm followed by NAA at 200 ppm showed the longest shoot (11.98 cm), earliest rooting (5.07 days), longest root (7.71 cm), maximum rooting percentage (100%), and survival percentage (100%).

Keywords: Chrysanthemum, terminal cuttings, auxins, rooting percentage, survival percentage.

INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora*) is a significant cut flower in the global trade, renowned for its beautiful flowers and long vase life. It is the second most traded flower after roses and is often referred to as the 'diva' or 'queen' of autumn gardens. While native to the northern hemisphere, especially Europe and Asia, it is cultivated worldwide due to its versatility in types, sizes, and colors. The taller varieties, known as standard chrysanthemums, are popular as cut flowers for bouquets and vase decorations (Singh and Chettri 2013).

Chrysanthemum can be propagated from stem cuttings, with each cutting requiring a minimum length of 5 inches and some foliage for photosynthesis to support root development (Muraleedharan *et al.,* 2020). However, traditional cultivation methods often result in poor-quality flowers, leading to lower competitiveness and profitability. While rooting capacity depends on both genetics and environmental factors (Horridge and Chockshull 1989), commercial propagation is mainly through terminal cuttings due to their rapid, cost-effective, and true-to-type nature (Waseem *et al.*, 2011). However, the low propagation rate of these cuttings has led to the importance of rooting hormones in improving rooting, root initiation, uniformity, number, and quality of roots (Mukherjee, 2008).

Rooting in chrysanthemum cuttings is facilitated by auxins, such as Indole Butyric Acid (IBA), Naphthalene Acetic Acid (NAA), and Indole Acetic Acid (IAA), which are commonly applied in liquid or powder form to promote rooting (Poteza, 2020). These hormones not only hasten root initiation but also increase the percentage of cuttings forming roots and the number of roots. The effectiveness of auxins varies among species and varieties (Poteza, 2020), with their discovery in 1934 marking a significant milestone in plant propagation (Debasis *et al.*, 2000).

MATERIALS AND METHODS

The experiment was conducted in the polyhouse house of the Department of Horticulture, Agriculture College, Bapatla, where the maximum temperature reached 32.55°C, and the relative humidity was 88.59%. Terminal cuttings of *Dendranthema grandiflora*, 4-5 cm in length with one or two buds, were obtained from the mother plot. Cocopeat was used as the rooting medium, filled into portrays. Eight auxin formulations at various concentrations were applied to twenty cuttings per treatment, each treatment being replicated three times.

The prepared cuttings were immersed in the respective auxin formulations for 2 minutes before being planted in the medium to a depth of 2 cm. the cuttings were carefully removed from the portrays, washed to remove media particles adhering to the roots, and assessed for root characteristics (e.g., days for root initiation, rooting percentage, length of longest root, number of roots, and success percentage after 20 days). Shoot characteristics were also recorded. The data were tabulated and analysed using the Completely Randomized Design (CRD) with nine treatments, each replicated three times, and statistically analyzed according to the methods outlined by Cochran and Cox (1992) using Fisher's analysis of variance techniques. Treatment details are presented in Table 1.

Table 1: Treatment details.

T_1	Control	T6	NAA-100ppm
T_2	IBA-100ppm	T7	NAA-150ppm
T_3	IBA-150ppm	T8	NAA-200ppm
T_4	IBA-200ppm	T9	NAA-250ppm
T_5	IBA-250ppm		

Table 2: Days taken for Shoot length, rooting, length of longest root, number roots as influenced by different auxins in cuttings of chrysanthemum.

Treatments	Length of shoot (cm)		Days taken for rooting	Length of longest root(cm)	Number of roots	Survival percentage (%)
	10DAP	20DAP				
T_1: Control	3.49	5.34	11.13	5.13	26.00	95.67
T_2: IBA@100ppm	5.89	10.67	6.67	6.50	41.27	97.67
T_3: IBA@150ppm	4.83	9.83	7.13	6.10	36.53	96.33
T_4: IBA@200ppm	5.67	11.37	6.07	6.71	43.67	99.00
T_5: IBA@250ppm	6.53	11.98	5.07	7.71	53.07	100.00
T_6: NAA @ 100ppm	5.70	11.43	5.63	6.87	57.40	99.00
T_7: NAA @ 150ppm	4.67	9.33	7.53	5.87	36.47	96.00
T_8: NAA @ 200ppm	6.09	11.08	6.93	6.87	52.98	99.00
T_9: NAA @ 250ppm	5.40	10.83	6.73	6.37	40.00	97.33

RESULT AND DISCUSSION

The impact of different auxins at varying concentrations significantly varied across treatments in terms of cutting length, rooting percentage, number of roots per cutting, root length, days to root initiation, and plant survival in pots, as detailed in Table 2. Cuttings treated with IBA at 250 ppm exhibited the longest root lengths at 10 and 20 DAP (6.53 cm and 11.98 cm, respectively), matching those treated with NAA at 250 ppm (6.09 cm and 11.08 cm, respectively), while the control group showed the shortest shoot lengths (3.49 cm and 5.34 cm, respectively). The IBA at 250 ppm treatment also resulted in the shortest rooting time (5.33 days), comparable to NAA at 200 ppm (5.63 days), with the control group requiring the longest time (11.13 days), possibly due to endogenous auxin translocation and the impact of exogenous IBA on cell division and elongation (Yusnita *et al.*, 2017). Additionally, cuttings treated with IBA at 250 ppm showed the longest root lengths (7.71 cm), followed by NAA at 200 ppm (6.87 cm) with the control group exhibiting the shortest (5.13 cm), potentially due to early root initiation leading to increased nutrient consumption (Jadhav, 2007). The maximum number of roots (53.07) was observed in cuttings treated with IBA at 250 ppm, similar to those treated with NAA at 200 ppm (52.98), while the control group had the minimum (26.00), likely due to increased cell division and enlargement. All treatments resulted in 100% rooting, attributed to the juvenile nature of the planting material. IBA application likely contributed to increased rooting by enhancing cell wall plasticity, cell division, callus development, and root growth. Furthermore, cuttings treated with IBA at 250 ppm exhibited the highest survival percentage (100%), similar to those treated with NAA at 150 ppm (99%), while the control group had the lowest (95.67%), possibly due to a higher number of longer primary and secondary roots aiding survival after transplantation.

CONCLUSIONS

In conclusion, based on the aforementioned results and discussions, it can be concluded that IBA at 250 ppm is the most effective for early root emergence, highest root number, rooting percentage, and greater survival percentage, with NAA at 200 ppm being the next best treatment for terminal cuttings of chrysanthemum.

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