INFLUENCE OF IBA AND NAA ON ROOTING OF TERMINAL CUTTINGS OF CHRYSANTHEMUM (*Dendranthema grandiflora* L.)

ABSTRACT

The present investigation was conducted at the Agricultural College and Research Institute, Vazhavachanur, Tiruvannamalai to study the effect of Indole-3-Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) on the rooting of terminal cuttings of chrysanthemum. An application of growth regulators (IBA and NAA) had a positive effect on the rooting of chrysanthemum terminal cuttings. The result of the experiment revealed that the treatment of IBA @ 400ppm significantly increased rooting percentage (89%), length of roots (5.67 cm), root spread (39.18 cm), number of roots (22.67), fresh weight of roots (4.94 g), plantlet weight (1.17 g), and plant height (8.87 cm) followed by NAA @ 400 ppm (79.33%), while minimum rooting percentage (47) was observed in control.

Key words: *Dendranthema grandiflora*, Terminal cuttings, Indole-3-Butyric Acid (IBA), Naphthalene Acetic Acid (NAA).

1. INTRODUCTION

India has diverse agro-climatic conditions, and flower crops are cultivated throughout the year in conventional and non-conventional areas. Floriculture is a fast growing agro-industry and has been associated with social culture and heritage in India. Since ancient times, it has been a tradition of growing flowers largely for religious purposes, the perfume industry, and landscaping. Chrysanthemum (*Dendranthema grandiflora L.*) belongs to the family Asteraceae, a popular perennial flowering plant, second only to roses in the international flower trade [1]. It is known for its long vase life and comes in a wide range of types, sizes, and colors. Chrysanthemum is used both as cut and loose flowers. Loose flowers are used for making garlands and for social and religious functions. Standard chrysanthemums are grown for cut flowers in bouquets and vase decorations [2, 3]. The rooting percentage low is a serious problem for the potted chrysanthemum because the cuttings are rooted in the definitive pot and the rooting unevenness. Consequently it will reflect on the unevenness of the final product. The commercial propagation of chrysanthemum is done by rooting of herbaceous cuttings previously treated with synthetic auxin, with indol butyric acid (IBA) being the most used, at a concentration of 1000 mg·L−1 [4]. In India, it is commonly propagated through

terminal cuttings and suckers from June to August. The propagation by stem cuttings is more feasible with the application of auxins. However, the root development percentage is low in some varieties, which can overcome by the use of growth regulators. The effect of IBA and NAA on rooting of chrysanthemum terminal cuttings indicated that cuttings with IBA at 400ppm performed well concerning the root development percentage [5]. [6] studied the effect of auxins on the rooting of terminal cuttings of *Chrysanthemum morifolium* cv. Flirt and recorded the highest number of roots per cutting with IBA at 250 ppm. The treatment of cuttings with auxins increases the number of adventitious roots that can naturally regenerate into roots. [7] reported that treating chrysanthemum cuttings with IAA and IBA at concentrations 0, 100, 200, 300 or 400 ppm significantly increased the number of roots compared with non- treated cuttings. However, their effectiveness varies among different species and varieties. 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 [8]. The present study investigates the effect of Indole-3-Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) on the rooting of terminal cuttings of chrysanthemum.

2. MATERIALS AND METHODS

The present investigation was conducted in a shade net house at Agricultural College and Research Institute, Vazhavachanur, Tiruvannamalai, Tamil Nadu. The experiment was laid out in Completely Randomized Design (CRD) with twelve treatments and three replications. The treatment details are furnished in Table 1. The required quantity of growth regulators IBA and NAA were carefully weighed using an electronic balance and dissolved in 10 ml of 95% ethyl alcohol with thorough shaking. The same was transferred to a volumetric flask to make the required volume with water. The growth regulators were prepared at 100, 200, 400, and 800 ppm concentrations. The chrysanthemum terminal cuttings were soaked with the growth regulars at different concentrations for 24 hours. River sand was treated with 0.2% carbendazim fungicide to prevent soil diseases. Same size pots were selected and filled with the media. Cocopeat was used as the rooting medium, filled into portrays. All pots were kept in partial shade. The rooting percentage, length of roots (cm), root spread (cm), number of roots plantlet^{-1}, fresh weight of roots (g), plantlet weight (g), and plant height (cm), were recorded in each treatment. The data were statistically analysed following the procedures outlined [9].

Table: 1. Treatment details

Treatments
T_0 – Control (water spray)
T_1 – IBA @ 100ppm
T_2 – IBA @ 200ppm
T_3 - IBA @ 400ppm
T_4 – IBA @ 800ppm
T_5 – NAA @ 100ppm
T_6 – NAA @ 200ppm
T_7 – NAA @ 400ppm
T_8 – NAA @ 800ppm
T_9 – IBA 100ppm + NAA @ 100ppm
T_{10} - IBA 200ppm + NAA @ 200ppm
T_{11} – IBA 400ppm + NAA @ 400ppm

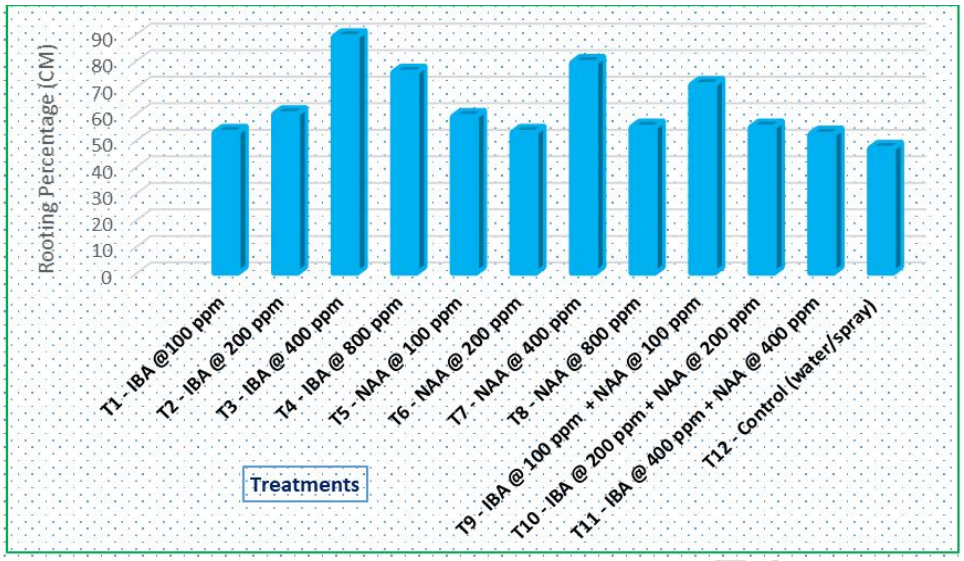
3. RESULTS AND DISCUSSION

The effects of different concentrations of auxins varied significantly among 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 shown in Table 2. The observation on rooting revealed that all the growth regulators had significant effect on rooting percentage (Table 2). The maximum rooting percentage was recorded in IBA @ 400 ppm (89%), followed by NAA @ 400 ppm (79.33%), while minimum rooting percentage (47) was observed in control (Figure 1). The results are also in conformity with the findings of [10]. It was also found that all the growth regulator treatments showed significant effect on length of roots. The maximum root length (5.67 cm) was observed in IBA @ 400 ppm followed by IBA @ 100 ppm + NAA @ 100 ppm combination (5.17cm), whereas minimum length of roots (3.60cm) was recorded in control. Similar result was obtained by [5, 11] in *Juniperus procera* and [12] in jasmine.

Table 2. Effect of IBA and NAA on rooting percentage, length of roots (cm), root spread (cm^2), no. of roots $plantlet^{-1}$, fresh weight of roots (g) and height of plant in Chrysanthemum terminal cuttings.

Treatments		**Rooting Percentage**	**Length of roots (cm)**	**Root spread (cm^2)**	**No. of roots $plantlet^{-1}$**	**Fresh weight of roots (g)**	**Weight of plantlet (g)**	**Height of plant (cm)**
T_1	IBA @100 ppm	53.00	3.83	30.57	17.67	3.29	0.68	7.70
T_2	IBA @ 200 ppm	60.00	4.50	34.78	17.00	3.12	0.93	7.73
T_3	IBA @ 400 ppm	89.00	5.67	39.18	22.67	4.94	1.17	8.87
T_4	IBA @ 800 ppm	75.67	4.27	31.29	20.67	4.10	0.59	8.57
T_5	NAA @ 100 ppm	59.00	3.80	30.09	17.00	3.08	0.58	7.93
T_6	NAA @ 200 ppm	53.00	4.13	29.66	16.33	2.93	0.63	7.63
T_7	NAA @ 400 ppm	79.33	4.47	34.44	20.00	3.71	0.75	8.03
T_8	NAA @ 800 ppm	55.00	4.67	38.89	18.00	3.78	0.77	8.47
T_9	IBA @ 100 ppm + NAA @ 100 ppm	71.00	5.17	29.17	20.67	3.43	0.77	7.67
T_{10}	IBA @ 200 ppm + NAA @ 200 ppm	55.00	4.20	27.52	17.00	3.44	0.61	7.83
T_{11}	IBA @ 400 ppm + NAA @ 400 ppm	52.33	4.10	26.61	16.33	3.44	0.60	7.33
T_{12}	Control (water/spray)	47.00	3.60	25.27	15.67	2.88	0.52	7.17
F-test		S	S	S	S	S	S	S
S. Ed (±)		2.37	0.09	0.59	0.43	0.10	0.04	0.12
C. D.(P= 0.05)		4.89	0.18	0.22	0.89	0.22	0.08	0.26

Figure 1. Effect of IBA and NAA in different concentration on rooting percentage.



All the growth regulator treatments showed a significant effect on root spread as compared to the control. The maximum root spread (39.18cm^2) was observed in IBA @ 400 ppm followed by NAA @ 800 ppm (38.89cm^2) and it was minimum in control (25.27cm^2). Indole butyric acid treatment recording maximum root spread in chrysanthemum cuttings was also observed by [5]. The growth regulators showed a significant effect on the number of roots plantlet^{-1}. The maximum number of roots per cutting (22.67) was recorded in IBA @ 400 ppm, followed by IBA @ 100 ppm + NAA @ 100 ppm combination (20.67) as compared to control (15.67). [13] studied the effect of different levels of IBA on rooting, growth and flower yield of chrysanthemum cv. Sonali Tara and reported maximum survival percentage with IBA at 2000ppm followed by IBA at 1000ppm. [14] Panahi and Morteza16, studied the effect of auxins on rooting and flowering of carnation cultivars (*Dianthus caryophyllus* L.) and recorded highest number of roots per cutting with IBA at 100ppm. Moreover, Chrysanthemum 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 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 [15]. 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 [16]. Auxin treatment significantly reduces the time-to-rooting and early rooting was recorded with the 500 ppm IBA (20.60 days) over 200 ppm (22.53 days). This might be due to the internal auxin amount is not enough for root induction of cuttings. IBA significantly increased the number of roots per cutting and found maximum (13.84) in 500 ppm IBA. The more number of roots obtained with the application of growth chemicals clearly reflects that they not only initiate rooting but also help in subsequent rapid growth of roots in numerical strength [17]. [18] also reported that IBA treated cuttings had increased the number of roots per cutting in chrysanthemum, [19] also observed similar results in carnation stem cutting. [20] obtained not only high percentage of rooting but also a large number of roots in many root trees and climbers by treating with IBA and NAA in talc. The growth regulators had a significant effect on the fresh weight of roots. The maximum fresh weight of roots (4.94g) was observed in IBA @ 400 ppm, followed by IBA at 400 ppm (4.10g) while the minimum fresh weight of roots (2.88g) was recorded in control. A similar result was obtained in the stem cuttings of chrysanthemum by [5, 6]. All the treatments showed a significant effect on plantlet weight. The maximum plantlet weight (1.17g) was also recorded in IBA at 400 ppm, followed by IBA at 200 ppm (0.93g). A similar results were obtained in chrysanthemum cuttings by [5, 21]. The plant height was also influenced by the growth regulator treatments. The maximum plant height (8.87cm) was recorded in IBA at 400 ppm, followed by IBA at 400 ppm (8.57cm), [19] and [21] also obtained increased in plant height with IBA treatment.

4. CONCLUSION

Based on the experiment, it can be concluded that the treatment of IBA @ 400ppm significantly increased rooting percentage, roots length, number of roots, plantlet weight and plant height has greater survival percentage in the terminal cuttings of chrysanthemum (*Dendranthema grandiflora*).

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 the writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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