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**SB Malaviya**
Department of Floriculture and Landscape Architecture, College of Horticulture, Junagadh Agricultural University, Junagadh, Gujarat, India

**BV Thumar**
College of Agriculture, Junagadh Agricultural University, Mota-bhandariya, Amreli, Gujarat, India

**MP Nakum**
Department of Floriculture and Landscape Architecture, College of Horticulture, Junagadh Agricultural University, Junagadh, Gujarat, India

**TP Dodiya**
College of Agriculture, Junagadh Agricultural University, Mota-bhandariya, Amreli, Gujarat, India

**Corresponding Author:**
**SB Malaviya**
Department of Floriculture and Landscape Architecture, College of Horticulture, Junagadh Agricultural University, Junagadh, Gujarat, India

# Efficacy of IBA on rooting of cuttings, growth and survival of croton (*Codiaeum variegatum* L.)

**SB Malaviya, BV Thumar, MP Nakum and TP Dodiya**

**Abstract**
The experiment was conducted at Hi-tech Horticulture Park, College of Horticulture, Junagadh Agricultural University, Junagadh (Gujarat) during September to December-2021. The experiment was laid out with Completely Randomized Design with four replications. Application of IBA @ 300 ppm proved to be significant for the semi-hardwood cuttings of croton for the parameters like minimum days required for sprouting (21.50 days), maximum success percentage (85.00%), survival percentage (82.32%), number of leaves (15.05), number of shoots (3.60), leaf area (109.73 $cm^2$), length of main shoot (6.72 cm), girth of main shoot (2.81 mm), fresh weight of shoot (4.98 g), dry weight of shoot (2.69 g), number of roots (29.85), length of longest root (13.27 cm), fresh weight of roots (2.15 g), dry weight of roots (1.86 g), minimum mortality percentage (17.67%) and maximum root: shoot ratio (0.43).

**Keywords:** IBA, rooting, cuttings, growth, survival, croton

## Introduction

Croton (*Codiaeum variegatum* L.) is an ornamental shrub which originates in tropical forests. It is indigenous to India, Malaysia and the Pacific Islands. Croton is a species of plant in the genus *Codiaeum*, which is a member of the family Euphorbiaceae. The plant grows in an array of shapes and colors including red, orange, purple, pink, yellow, green and white. A wide range of variations in leaf shape and coloration had fascinated breeders, landscapers, horticulturists and gardeners and a huge number of cultivars have been fixed for commercial production. Crotons are primarily attractive in their value. Adding a croton plant brings a splash of color to an otherwise green landscape. Because crotons are in regular demand, there is a need for fast propagation methods with low cost and that guarantee the formation of vigorous and high-quality seedlings. Vegetative propagation by cuttings allows the propagated plant to keep all the genetic characteristics of the mother plant and the production of large quantities of precocious and uniform seedlings.

In addition to its aesthetic value as an indoor plant, crotons are also well known for their medicinal value. Extract of croton leaves is reported to have many medicinal properties i.e., purgative, sedative, antifungal, antiamoebic and anticancerous activities (Deshmukh & Borle, 1975; Kupchan *et al*., 1976) [1, 6]. The plant is also used for the production of valuable secondary metabolites of alkaloids, terpenes and flavonoids in nature (Puebla *et al*., 2003; Maciel *et al*., 1998; Martins *et al*., 2002) [12, 7, 8].

Propagating a plant by cuttings will allow nurserymen to keep the special characteristics of the plant. Plants grown from seed will often be different from the parent plant and may be from each other. Propagating a new plant via cuttings avoids the difficulties of propagating by seed and give true-to-type plants. The root promoting hormones contribute important role to the process of promoting new roots in the cuttings of hibiscus and their survival.

Plant growth regulators are now widely used for plant propagation, particularly in the induction of rooting in cuttings. The most commonly used plant growth regulators for better rooting of cuttings are IAA, IBA and NAA. Among these auxins, IBA and NAA have proved to be the best for proper root growth and are widely used for successful rooting of cuttings. In croton, dracaena and hibiscus sometimes cuttings fail to survive because of delayed rooting or might be due to meager number of roots.

## Material and Methods

The experiment was conducted at Hi-tech Horticulture Park, College of Horticulture, Junagadh Agricultural University, Junagadh (Gujarat) during September to December-2021. The experiment was laid out with Completely Randomized Design with four replications.

The experiment comprising of six treatments including: $T_1$ (Control), $T_2$ (IBA 250 ppm), $T_3$ (IBA 300 ppm), $T_4$ (IBA 350 ppm), $T_5$ (IBA 400 ppm), $T_6$ (IBA 450 ppm).

The selected five plants were marked with tags for recording observations. The observations like number of days to new sprout, success percentage (%), number of leaves, number of shoots, leaf area ($cm^2$), length of main shoot (cm), girth of main shoot (mm), number of roots, length of longest root (cm), fresh weight of shoot (g), fresh weight of roots (g), dry weight of shoot (g), dry weight of roots (g), root: shoot ratio, survival percentage of cuttings (%), mortality percentage of cuttings (%) parameters were recorded. The cutting was planted for each treatment in each replication in poly bags (8"x6") one cutting in each bag. Two third parts of cuttings were inserted in the soil at slight angle to the vertical. The data was statistically analyzed by method of analysis of variance using Completely Randomized Design as described by Panse and Sukhatme (1985) [11].

## Result and Discussion

Table 1 showed that days taken to sprouting significantly minimum (21.50 days) in $T_3$ which was at par with $T_2$. Whereas, maximum number of days for new sprout (25.78 days) in $T_1$. This result is probably due to the application of IBA at suitable concentrations that increased IBA oxidase activity and promoted earlier sprouting. Plant growth regulators can speed up the vegetative propagation of ornamental plants. The above result is in conformity with Devi *et al.* (2016) [2] in phalsa. The maximum success percentage (85.00%) in $T_3$ which was at par with $T_2$, $T_4$ and $T_5$. Whereas, minimum success percentage (66.25%) in $T_1$. This might be due to the fact that auxin is known to induce stimulus for regeneration of roots by promotion of hydrolysis, mobilization and utilization of nutritional reserves in the region of root and shoot formation (Nanda, 1975) [10]. This result is in close approximately with the findings of Sultana (2006) [17] in nerium, bougainvillea and Jasminum and Hemlata *et al.* (2013) [4] in croton. The maximum survival percentage (82.32%) in $T_3$. Whereas, minimum survival percentage (60.30%) in $T_1$. The survival of the cuttings treated with IBA may be directly linked with the capacity of the growth regulator to stimulate the generation of adventitious roots. The adventitious roots absorb mineral nutrients from the soil, which helps in the survival of the cuttings. This result is in agreement with the findings of Jan *et al.* (2015) [5] in olive. Minimum mortality percentage (17.67%) in $T_3$. Whereas, maximum mortality percentage (39.69%) in $T_1$. This might be due to stronger framework of root system lead to less number of failure cuttings.

**Table 1:** Effect of IBA on sprouting parameters of cuttings in croton

| Treatment | Days to new sprout | Success percentage (%) | Survival percentage (%) | Mortality percentage (%) |
|---|---|---|---|---|
| $T_1$: Control | 25.78 | 66.25 | 60.30 | 39.69 |
| $T_2$: IBA 250 ppm | 22.34 | 82.50 | 76.99 | 23.01 |
| $T_3$: IBA 300 ppm | 21.50 | 85.00 | 82.32 | 17.67 |
| $T_4$: IBA 350 ppm | 23.29 | 81.25 | 75.65 | 24.35 |
| $T_5$: IBA 400 ppm | 23.57 | 78.75 | 73.06 | 26.93 |
| $T_6$: IBA 450 ppm | 24.20 | 75.00 | 63.36 | 36.63 |
| S.Em.± | 0.584 | 2.301 | 1.297 | 1.297 |
| C.D. at 5% | 1.74 | 6.83 | 3.85 | 3.85 |
| C. V.% | 4.98 | 5.89 | 3.60 | 9.25 |

Table 2 revealed that the maximum number of leaves (15.05) in $T_3$ which was at par with $T_2$. Whereas, minimum number of leaves (7.50) in $T_1$. Increase in leaf number may be due to their significant effect on inducing vigorous rooting system by growth regulators thus enabling the cuttings to absorb more nutrients thereby producing more leaves. This result is in agreement with the findings of Singh *et al.* (2013) [16] in night queen, Singh (2001) [15] in jasmine. The maximum number of shoots (3.60) in $T_3$ which was at par with $T_2$. Whereas, minimum number of shoots (2.75) in $T_1$. This might be due to enhancement of physiological functions in the cuttings favorably at this concentration. Maximum leaf area (109.73 $cm^2$) in $T_3$ which was at par with $T_2$. Whereas, minimum leaf area (67.94 $cm^2$) in $T_1$. Maximum values recorded in cuttings treated with IBA 300 ppm might be due to early sprouting with a consequent higher level of photosynthates and/or dry matter production and as well as greater absorption of nutrients and water from the soil encouraging fast growth. The above result is in conformity with Devi *et al.* (2016) [2] in phalsa. Maximum length of main shoot (6.72 cm) in $T_3$ which was at par with $T_2$ and $T_4$. Whereas, minimum length of main shoot (3.85 cm) in $T_1$. As a growth promoter IBA promotes cell division, which results in early rooting leading towards efficient absorption of mineral nutrient and hence maximizes shoot length. This result is in agreement with the findings of Jan *et al.* (2015) [5] in olive and Naghmouchi *et al.* (2008) [9] in *Ceratonia siliqua*. Maximum girth of main shoot (2.81 mm) in $T_3$ which was at par with $T_2$, $T_4$ and $T_5$. Whereas, minimum girth of main shoot (1.95 mm) in $T_1$. These might be due to high number of roots and leaves. This result is in agreement with the findings of Jan *et al.* (2015) [5] in olive and Siddiqui and Hussain (2007) [14] in *Ficus hawaii*.

Table 2 also showed that the maximum fresh weight of shoot (4.98 g) in $T_3$ which was at par with $T_2$ and dry weight of shoot (2.69) in $T_3$. Whereas, minimum fresh weight of shoot (3.98 g) and dry weight of shoot (1.44 g) was observed in $T_1$. The increase in the production of the leaves and leaf area ultimately increased photosynthesis, relative growth rate and growth of lateral branching of shoot which were increased fresh biomass of shoot consequently dry biomass of shoot. This result is in close approximately with the findings of Shalini (2017) [13] in marigold.

**Table 2:** Effect of IBA on vegetative growth parameters of cuttings in croton

| Treatment | Number of leaves | Number of shoots | Leaf area ($cm^2$) | Length of main shoot (cm) | Girth of main shoot (mm) | Fresh weight of shoot (g) | Dry weight of shoot (g) |
|---|---|---|---|---|---|---|---|
| $T_1$: Control | 7.50 | 2.75 | 67.94 | 3.85 | 1.95 | 3.98 | 1.44 |
| $T_2$: IBA 250 ppm | 14.35 | 3.50 | 104.73 | 4.82 | 2.66 | 4.91 | 2.50 |
| $T_3$: IBA 300 ppm | 15.05 | 3.60 | 109.73 | 6.72 | 2.81 | 4.98 | 2.69 |
| $T_4$: IBA 350 ppm | 12.90 | 3.30 | 98.24 | 4.07 | 2.63 | 4.44 | 2.48 |
| $T_5$: IBA 400 ppm | 11.20 | 3.15 | 91.53 | 4.05 | 2.62 | 4.41 | 2.16 |
| $T_6$: IBA 450 ppm | 10.75 | 2.90 | 87.97 | 3.90 | 1.67 | 4.02 | 1.58 |
| S.Em.± | 0.266 | 0.074 | 2.367 | 0.133 | 0.076 | 0.091 | 0.052 |
| C.D. at 5% | 0.79 | 0.22 | 7.03 | 0.39 | 0.22 | 0.27 | 0.15 |
| C. V.% | 4.46 | 4.66 | 5.07 | 5.83 | 6.42 | 4.11 | 4.92 |

Table 3 showed that the maximum number of roots (29.85) in $T_3$. Whereas, minimum number of roots (13.95) in $T_1$. The above finding indicated that the treated cutting by auxin with appropriate concentration induces early and better root initiation. Thus, the maximum number of roots were produced in those treatment which received appropriate concentration of auxin. This might be due to auxin application which initiate early and more root per cuttings. The number of roots are increase by the application of auxin is a common feature in many herbaceous perennial crops (Hartmann *et al*., 2002) [2]. This result is in agreement with the findings of Shalini (2017) [13] in marigold and Jan *et al.* (2015) [5] in olive. Maximum length of longest root (13.27 cm) in $T_3$. Whereas, minimum number of roots (8.98 cm) in $T_1$. The increase in root length may be due to the maximum number of branches per shoot whose tips produces more auxin which results in root elongation and the effect of metabolites translocation and carbohydrates metabolism. This result is in agreement with the findings of Jan *et al.* (2015) [5] in olive.

Table 3 also revealed that the maximum fresh weight of roots (2.15 g) and dry weight of root (1.86) in $T_3$. Whereas, minimum fresh weight of roots (0.97 g) and dry weight of root (0.62) in $T_1$. Auxin treatment induced higher number of roots, cell elongation of roots with cell division and consequently accounting for higher fresh weight and thus dry weight of roots. This result is in agreement with the findings of Shalini (2017) [13] in marigold. The maximum root: shoot ratio (0.43) in $T_3$. Whereas, minimum root: shoot ratio (0.24) in $T_1$ and $T_6$. The increase in the production of the leaves and leaf area ultimately increased photosynthesis, relative growth rate and growth of lateral branching of shoot which were increased fresh biomass of shoot and root: shoot ratio.

**Table 3:** Effect of IBA on root growth parameters of cuttings in croton

| Treatment | Number of roots | Length of longest root (cm) | Fresh weight of roots (g) | Dry weight of roots (g) | Root: shoot ratio |
|---|---|---|---|---|---|
| $T_1$: Control | 13.95 | 8.98 | 0.97 | 0.62 | 0.24 |
| $T_2$: IBA 250 ppm | 23.80 | 11.86 | 1.77 | 1.29 | 0.36 |
| $T_3$: IBA 300 ppm | 29.85 | 13.27 | 2.15 | 1.86 | 0.43 |
| $T_4$: IBA 350 ppm | 21.25 | 11.81 | 1.16 | 0.85 | 0.26 |
| $T_5$: IBA 400 ppm | 18.32 | 10.26 | 1.21 | 0.74 | 0.25 |
| $T_6$: IBA 450 ppm | 17.80 | 9.85 | 0.99 | 0.66 | 0.24 |
| S.Em.± | 0.564 | 0.279 | 0.032 | 0.021 | 0.006 |
| C.D. at 5% | 1.67 | 0.83 | 0.09 | 0.06 | 0.02 |
| C. V.% | 5.41 | 5.05 | 4.77 | 4.25 | 4.64 |

## Conclusion
On the basis of experimental data, it can be concluded that among different concentration of IBA, 300 ppm IBA for croton cuttings showed better result in all parameters like number of days to new sprout, success percentage, number of leaves, number of shoots, leaf area, length and girth of main shoot, number of roots, length of longest root, fresh weight of shoot and roots, dry weight of shoot and roots, root: shoot ratio, survival and mortality percentage of cuttings. Also, 300 ppm IBA for semi-hardwood cuttings of croton gave better results with quick dip method (5 minutes) for highest success and survival rate.

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## References
1. Deshmukh SD, Borle MN. Studies on the insecticidal properties of indigenous plant products. Indian Journal of Entomology.1975;37(1):11-18.
2. Devi J, Bakshi P, Wali VK, Kiran K, Sharma N. Role of auxin and dates of planting on growth of cutting raised plantlets of phalsa (*Grewia asiatica* L.). An International Quarterly of Life Sciences. 2016;11(1):535-537.
3. Hartmann HT, Kester DE, Davies JR, Geneve RL. Hartmann and Kester's plant propagation: Principles and practices, 7th ed. Prentice hall, Upper Saddle. NJ, 2002.
4. Hemlata B, Singh BP, Singh KP. Effect of variety, type of cutting and IBA concentration on rooting of croton (*Codiaeum variegatum*) cuttings. Hort Flora Research Spectrum. 2013;2(4):363-365.
5. Jan I, Sajid M, Rab A, Iqbal A, Khan O, Jamal Y, *et al*. Effect of various concentrations of indole butyric acid (IBA) on olive cuttings. Mitt Eilungen Klosterneuburg. 2015;65:49-55.
6. Kupchan SM, Uchida IA, Branfman RC, Fei BY. Antileukemic principles isolated from *euphorbiaceae* plants. Sciences. 1976;191(4227):571-572.
7. Maciel AM, Pinto SN, Brabo A, Silva MN. Terpenoids from *Croton cajura.* Phytochemistry. 1998;49(2):823-826.
8. Martins AP, Salgueiro LR, Conclaves MJ, Vila R, Tomi

F, Adzet T, *et al*. Antimicrobial activity and chemical composition of bark oil of *Croton stellulifer*. Planta Medica. 2002;66(1):647-652.
9. Naghmouchi S, Khouja ML, Rejeb MN, Boussaid M. Effect of growth regulators and explant origin on *in vitro* propagation of *Ceratonia siliqua* L. via cuttings. Biotechnol. Agron. Soc. Environ. 2008;12(3):251-258.
10. Nanda KK. Indian Journal of Plant Physiology. 1975;18:80-89.
11. Panse VG, Sukhatme PV. Statistical methods for Agricultural Workers. Indian Council of Agricultural Research Publication, 1985, 87-89.
12. Puebla P, Lopez M, Guerrero R, Carron ML, Martin LS, Feliciano AS. Neo-clerodane diterpenoids from *Croton schiedeanus*. Phytochemistry. 2003;62(2):551-554.
13. Shalini K. Effect of IBA and NAA and their combination on rooting in stem cuttings of african marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda. M. Sc. Thesis submitted to Krishi Vishwavidyalaya, Raipur, 2017.
14. Siddique MS, Hussain SA. Effect of indole butyric acid and types of cuttings on root initiation of *Ficus hawaii*. Sarhad Journal of Agriculture. 2007;23(4):44-51.
15. Singh AK. Effect of auxins on rooting and survival of jasmine (*Jasminum sambac* Ait.) stem cutting. Progressive Horticulture. 2001;33(2):174-177.
16. Singh KK, Rawat V, Rawat JMS, Tomar YK, Kumar P. Effect of IBA and NAA concentrations on rooting in stem cuttings of night queen (*Cestrum nocturnum* L.) under Sub-tropical valley conditions. Hort Flora Research Spectrum. 2013;2(1):81-83.
17. Sultana Z. Rooting performance of stem cuttings of three ornamental plants as influenced by growth regulators. M. Sc. Thesis submitted to Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, 2006.