Agrotechniques in Industrial Crops

Journal Homepage: https://atic.razi.ac.ir

Cutting Type and IBA Hormone on Rooting Traits of *Hibiscus rosa sinensis*

Fatemeh Bidarnamani*

Agriculture Institute, Research Institute of Zabol, Zabol, Iran

ARTICLE INFO

Original paper

Article history:
Received: 22 Apr 2025
Revised: 15 Jul 2025
Accepted: 08 Nov 2025

Keywords:
Auxin
Hormone
Ornamental plants
Perlite

ABSTRACT

Hibiscus rosa sinensis is an ornamental plant with attractive flowers. Generally, this plant is propagated by cutting. A trial was carried out in a greenhouse in the Agriculture Institute, Research Institute of Zabol, in 2022. To conduct the experiment, a factorial design with 12 treatments was used in a completely randomized design. Two factors were used in this research: IBA concentration (0, 1500, 3000 and 4500 ppm) and type of cutting (terminal, intermediate or semi-hardwood and bottom cuttings or hardwood cuttings). According to the result, the effect of different concentrations of IBA, cutting type and their interaction was significant on rooting percentage of cuttings, number of roots in each cutting, and the length of root in each cutting ($P \leq 0.01$). The total length of roots in each rooted cutting showed that the effect of cutting type was not significant, but hormone and the interaction of hormone and cutting type had significant effect on this trait ($P \leq 0.01$). The concentration of 4500 ppm IBA was the best in all of the traits. There is no significant effect between 1500 and 3000 ppm in rooting percentage and number of roots, but they showed significant effect with 4500 ppm IBA. Terminal cuttings had the most rooting percentage, which had significant differences with bottom cuttings, but they had no significant differences in the number of roots. Finally, terminal cutting and 4500 ppm ABA are suggested for rooting of *H. rosa sinensis* cuttings.

DOI: 10.22126/ATIC.2026.12056.1213
© The Author(s) 2026. Published by Razi University

1. Introduction

Chinese hibiscus (*Hibiscus rosa sinensis*) is a well-known member of the Malvaceae family (Mitra *et al*., 2024). The propagation of hardwood ornamental plants involves to use of synthetic auxin that which is used at the bottom of cuttings and the root develops from cutting (Bowden *et al*., 2022). Softwood terminals, maturing green wood, and matured intermediate wood stem cuttings can be used for propagation of blueberry (*Vaccinium corymbosum* L.) (Braha and Rama, 2018). Softwood terminals of easy-to-root cultivars do not require a rooting hormone. With more mature wood, a rooting hormone such as IBA (3-indolebutryic acid) at 2000-6000 ppm is commonly used (Karabulut and Saraçoğlu, 2022). Izadi and Zarei (2014) reported that Stentlings in *Hibiscus rosa scinensis* that were treated with 3000 and 5000 ppm of IBA produced the greatest leaf number. The result of Rahdari et al. (2011) on the effect of different concentrations of plant hormones and zinc-sulfate on rooting of *Dracaena fragrans* cuttings showed that the most rooting percentage belonged to 2000 ppm IBA treatment and 2000 ppm NAA treatment and IBA (2000 ppm) + NAA (1000 ppm) and zinc-sulfate (3000 ppm). They concluded that the best treatment was IBA (2000 ppm).

Vegetative propagation by stem cuttings is widely used because it can rapidly produce plants genetically similar to the mother plant; however, adventitious rooting is influenced by cutting position, physiological age, endogenous carbohydrate and hormone status, and the propagation environment (Liu *et al*., 2025). Exogenous auxins, particularly indole-3-butyric acid (IBA), are routinely used to enhance adventitious root initiation in stem cuttings. Recent work indicates that auxin does not simply act as a general growth stimulant; rather, local auxin accumulation and conversion of IBA to indole-3-acetic acid (IAA), together with interactions with cytokinin and wound

* Corresponding author.
E-mail address: f.bidarnamani65@uoz.ac.ir

signalling, influence the competence of stem tissues to initiate adventitious roots (Damodaran and Strader, 2024). Baldotto et al. (2012) reported favorable results on the propagation by cuttings in Hibiscus using the bio-stimulators IBA (indolbutyric acid) and HA (humic acid). Various concentrations of NAA and IBA on the rooting of softwood cutting of *Hibiscus rosa scinensis* showed that among all the treatments, number of sprouted cuttings (9.000), number of primary roots (18.667), percentage of rooted cuttings (90.000), length of longest sprout (7.800 cm) of root were higher in IBA 2000 ppm (Singh, 2014).

Auxin concentration is another major determinant of adventitious rooting. A recent study in *H. rosa-sinensis* reported that 2000 mg L−1 IBA produced high rooting percentage, root number and root length (Kaushik *et al*., 2025). The effect of variety, hormone, culture medium and their interaction effect were significant on root number, root length and shoot height and root length was significant (Otiende *et al*., 2017; Tawfik *et al*., 2018). Radistim and Atonic biostimulators, and rooting substrates (sand, sand: perlite, sand: peat and sand:peat: perlite) differentially influenced the rooting of cuttings in the three varieties of *H. rosa sinensis* (Băla and Sala, 2020).

Devika et al. (2022) reported that the rooting efficiency was high in IBA. The results showed that IBA 500ppm had with maximum root growth, followed by IBA 250 ppm. Bud proliferation showed a reverse effect, with the maximum reduction in bud growth observed in higher concentrations of both IAA and IBA. An enhanced proliferation of buds was observed in cuttings treated with *Aloe vera* gel. Other research showed that stem cutting and grafting are the most important methods of vegetative propagation. The cuttings treated with high concentration of IBA performed the best in rooting and survival percentage. Semi-hardwood cuttings and cleft grafting gave the best result in terms of rooting and survival performance (Chatse and Kedar, 2021).

Rosa cuttings showed the most root number and root length in 2 culture media: peat + perlite; peat + sawdust. Rooting percentage was significant and mixture of perlite+cocopeat+sand had the most rooting percentage among others that didn't have significant differences from the perlite medium (Ercişli *et al*., 2004). Magyar-Tábori et al. (2021) explained that hyperconcentration of auxin had caused yellowing and leaf falling, blackening the shoot and finally drying, if suitable concentration of auxin wasn't toxic and it had caused resistance and increased the callus and root production. At the physiological level, auxin promotes the cellular reprogramming required for adventitious root formation, but excessive auxin can inhibit subsequent development or cause phytotoxic responses. The concentration-response relationship is therefore expected to be nonlinear rather than universally increasing (Liu *et al*., 2025; Roth *et al*., 2024).

Zarrinbal et al. (2005) concluded that the length of the largest root, average of root length and dry weight of root were significant in *Callistemon viminalls* and the length of new shoot growth was in treatment IBA (4000 ppm) more than others. Lima et al. (2019) reported that treating semi-hardwood cuttings with IBA from 1000 to 4000 ppm increased rooting percentage and number of roots in each cutting. Shadparvar et al. (2011) showed that the treatment of 4000 ppm IBA had the most rooting percentage in rooting of *H. rosa sinensis* cuttings. The objective of this study was to determine the effect of cutting type and different concentrations of IBA on rooting traits of *Hibiscus rosa scinensis*.

2. Materials and methods

To evaluate the effect of IBA concentration and cutting type on rooting characteristics of *Hibiscus rosa chinensis* cuttings, this research was conducted in the greenhouse of the Agriculture Institute in the Research Institute of Zabol in 2022. The experiment was carried out in a factorial design on a completely randomized design with 12 treatments. Treatments were containing IBA (0, 1500, 3000 and 4500 ppm) and cutting type (terminal cuttings, intermediate cuttings or semi-hardwood cutting, bottom cuttings or hardwood cutting) with three replications. The medium for all of treatments was perlite 3-5 mm (Fig. 1).

Due to the hot weather in the summer and early fall in Zabol city, cuttings from the plant were taken from the plant in mid-fall. Greenhouse. A glass-covered greenhouse was also used to store the *Hibiscus rosa chinensis* for rooting cuttings. The temperature inside the greenhouse was maintained below 25°C. Mist was used for provision of humidity in the greenhouse. Rooting parameters were measured after two months, such as rooting percentage (%), number of roots, root

length (mm), and the length of the biggest root by digital caliper. Data analysis was done by SPSS 17 at 5% probability level and mean comparison by Duncan's Multiple Range Test.

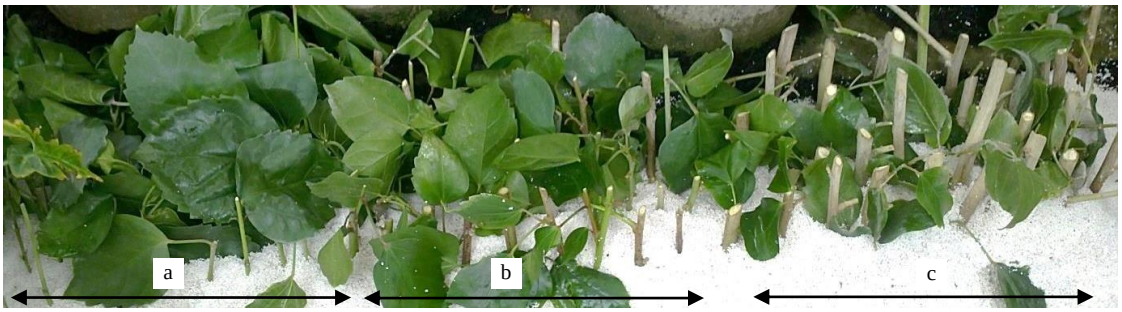


Figure 1. Different types of cuttings of *Hibiscus rosa sinensis* in perlite media for rooting. a: terminal cuttings; b: intermediate cuttings or semi-hardwood cutting; c: bottom cuttings or hardwood cutting

3. Results and discussion

The result of this research showed that the effect of hormone and cutting type was significant on some of the parameters. A summary of the results is shown in Table 1.

Table 1. Analysis of Variance of different treatments in rooting of *Hibiscus rosa sinensis*

S.O.V.	d.f.	Mean Square			
		Rooting percentage	Root number	Longest root length	Total root length
IBA	3	2099.5**	207.3**	28496**	167638**
Cuttings type (C)	2	771.6**	31**	32878**	19751ns
IBA × C	6	524.8**	40.9**	11114**	42290**
Error	24	1	4.7	31.1	14472
CV (%)	-	13.76	12.87	16.93	24.33

** significant on 1% probability, * significant on 5% probability, ns is non-significant.

3.1. Rooting percentage

Evaluation of different treatments of IBA hormone and different types of cutting and their interaction had significant effect on rooting percentages of *H. rosa sinensis* (P≤0.01). The addition of IBA concentration augmented rooting percentages of *hibiscus* cuttings, as rooting percentage in treatments containing 1500 and 3000 ppm were the same, but IBA (4500 ppm) had the most rooting percentage among others. Also rooting percentage in all of treatments containing IBA hormone was better than the control. Shadparvar et al. (2011) showed that the treatment of 4000 ppm IBA had the most rooting percentage in rooting of *H. rosa sinensis* cuttings. But in this research, it was found that a higher concentration of IBA (than 4000 ppm) had a higher rooting percentage. Different types of cuttings with varying diameters had a significant effect on rooting percentage. Terminal cuttings, which had the smallest diameter, exhibited the highest rooting percentage and had a significant effect compared to the other treatments. Intermediate and bottom cuttings did not show significant differences. The interaction of hormone and cutting type was significant on rooting percentage of *Hibiscus rosa scinensis* cutting (Fig. 2). The results showed that terminal cuttings treated with 4500 ppm IBA had the most rooting percentage and intermediate cuttings in control treatment had the lowest rooting percentage.

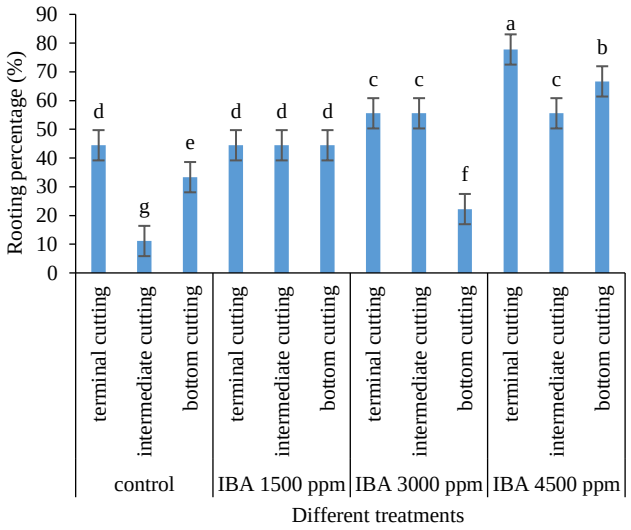


Figure 2. Interaction effect of IBA concentration and cutting type on rooting percentage of *Hibiscus rosa scinensis* cutting

Some researchers (Chatse and Kedar, 2021; Chowdhari *et al*., 2017) reported that semi-hardwood cuttings of Hibiscus rosa scinensis had the best result in terms of rootings and survival performance, while in this research, terminal cuttings were the best. Application of 1000-3000 ppm IBA and NAA showed that the best growth regulator was IBA (3000 ppm). In this study, the use of 4500 ppm IBA had a higher rooting percentage than 1500 and 3000 ppm. Chatse

and Kedar (2021) studied on effect of IBA on different types of cutting for rooting in *H. rosa sinensis*, found that maximum percentage of rooting was by hardwood cutting with IBA 1000 mg L^{-1}.

3.2. Number of roots in each cutting

This research showed that hormone and cutting type and their interaction were significant (P≤0.01) on number of roots (Table 1). The physiological basis of this response is consistent with recent evidence that auxin signaling contributes to cellular reprogramming at wound sites and that IBA-derived auxin participates in establishing the competence of tissues to form adventitious roots (Damodaran and Strader, 2024). It may be due to the positive response to IBA should not be interpreted as a simple linear effect of concentration. Auxin must be present at an appropriate concentration and location to stimulate root initiation, whereas excessive or prolonged auxin exposure can inhibit subsequent root development. Recent research on woody plants has demonstrated that controlled auxin delivery can markedly improve adventitious rooting, while emphasizing the importance of dose and exposure conditions (Roth *et al*., 2024). There are not significant differences significant differences in number of roots in each cutting in 1500 and 3000 ppm IBA. According to the result and significant effect of cutting type on number of roots (P≤0.01), bottom cutting was the best treatment, it hadn't have significant differences to terminal cuttings. Bottom cutting or hardwood cuttings in 4500 ppm IBA had number of roots in each cutting. Terminal cutting in 4500 ppm IBA did not show significant differences with terminal cutting in 1500 ppm IBA. Cutting types of control treatment had the lowest number of roots (Fig. 3). The number of roots (18.667) was higher in 2000 ppm concentration of IBA), while in this experiment higher concentration of IBA (4500 ppm) had more positive effect than low concentration and control.

3.3. The length of the largest root

This research showed that hormone and cutting type and their interaction were significant on the length of the largest root (P≤0.01). Quality of rooted cuttings is determined by the number of roots and their length, because cuttings with more roots and longer roots have more absorption than others. Alike rooting percentage, the treatment containing 4500 ppm IBA was better than others, so this treatment can be used by producers for better rooting of *hibiscus* cutting. The root length was greatest in terminal cuttings. The interaction between hormone treatment and cutting type showed that the intermediate cuttings under the control treatment of *H. rosa sinensis* had the longest roots, while terminal cuttings under the control treatment had the shortest roots (Fig. 4). Singh (2014) reported that the length of root (7.57 mm) in *H. rosa scinensis* was recorded in 2000 ppm NAA and 2000 ppm IBA hormone, while control treatment had minimum length of root (3.03 mm).

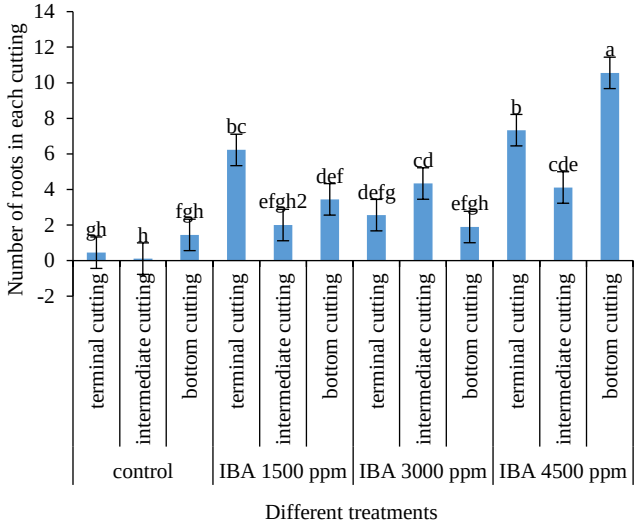


Figure 3. Different treatments on number of roots in each cutting of *Hibiscus rosa scinensis*

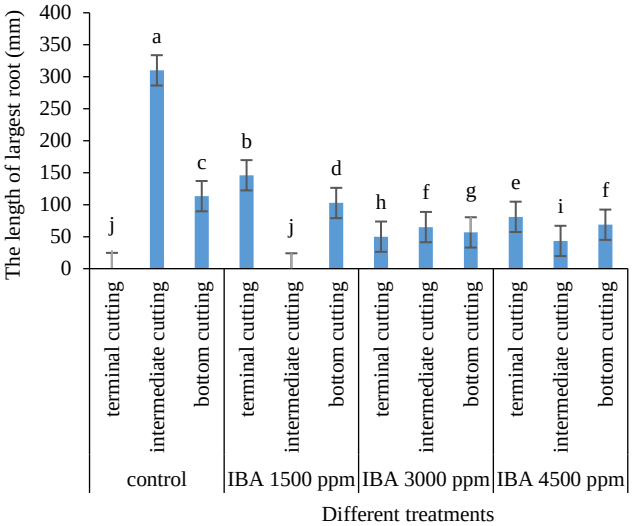


Figure 4. Effect of different treatments on the length of the longest root in *Hibiscus rosa sinensis*

3.4. Total length of rooted cuttings

This research showed hormone and the interaction of hormone with cutting type were significant on the length of the largest root (P≤0.01), but cutting type was

not significant. According to Fig. 5, the total length of roots in the control treatment was very low, as it had significant effect on other treatments ($P \leq 0.01$). Treatment containing 4500 ppm IBA had the most total length of roots, which did not show significant differences from 1500 ppm IBA. But these two treatments had significant differences from 1500 ppm IBA and control. Reduction of the total length of roots in 3000 ppm IBA toward other treatments that received hormone is due to a lower number of roots in this treatment. Terminal cutting in 1500 ppm IBA and bottom cutting in 4500 ppm IBA had the most length of total roots (Fig. 6).

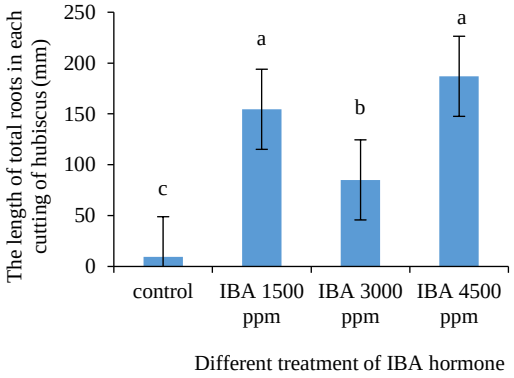


Figure 5. Effect of different concentrations on the length of total roots in each cutting of *Hibiscus rosa sinensis*

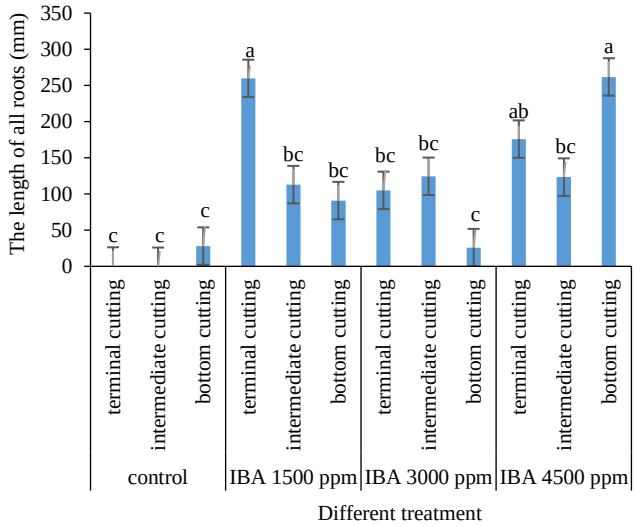


Figure 6. Interaction effect of hormone and cutting type on the total root length of *Hibiscus rosa sinensis*

Cutting types in control treatment did not show significant differences in this trait and together. Chowdhuri et al. (2017) reported that the maximum concentration of IBA in their experiment (3000 ppm) was the best for rooting of *Hibiscus rosa scinensis*. Chowdhuri et al. (2017) concluded that for *H. rosa sinensis*, higher doses of NAA (3000 ppm) are more beneficial during the rainy season in subtropical zones, with IBA at 3000 ppm being the second most effective growth regulator. They found that semi-hardwood cuttings are better than tip cuttings for propagating the China rose. However, in this research, terminal cuttings from the top of the stem exhibited the best rooting traits.

4. Conclusion

In general, the results of this study showed that the highest rooting percentage, longest root length, and greatest number of roots were found in terminal cuttings treated with 450 ppm IBA. The application of IBA significantly enhanced rooting traits compared to the control. Therefore, it is recommended to use IBA for improved rooting of *H. rosa sinensis*. Additionally, the position of the cutting on the shoot influenced rooting traits, with cuttings taken from the upper, thinner parts of the stem exhibiting better rooting than those from the middle and lower parts, which were semi-hardwood and hardwood cuttings. These latter types could potentially be used for air-layering propagation of this ornamental plant.

Conflict of interests

The author declares no conflict of interest.

Ethics approval and consent to participate

No humans or animals were used in the present research. The authors have adhered to ethical standards, including avoiding plagiarism, data fabrication, and double publication.

Consent for publications

The author read and approved the final manuscript for publication.

Availability of data and material

All the data are embedded in the manuscript.

Authors' contributions

The first draft of this manuscript was written by the researcher and has been revised and modified

Informed consent

The author declares not to use any patients in this research.

Funding/Support

This study was supported by the Research Institute of Zabol, Zabol, Iran.

Acknowledgement

This research was supported by the Research Institute of Zabol under Grant number: IR-RIOZ-GR-6918.

Generative AI statement

The author declares that generative AI (artificial intelligence) tools, including Grammarly & QuillBot, were used to enhance the language & clarity of this work. The author takes full responsibility for the accuracy & integrity of the content.

References

Băla M., Sala F. 2020. Management of *Hibiscus rosa siensis* L. propagation by optimizing the growth substrates and biostimulators combination. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development 20(1): 53-60. https://managementjournal.usamv.ro/pdf/vol.20_1/Art6.pdf

Baldotto L.E., Baldotto M.A., Soares R.R., Martinez H.E., Venegas V.H. 2012. Adventitious rooting in cuttings of croton and hibiscus in response to indolbutyric acid and humic acid. Revista Ceres 59(4): 476-483. https://doi.org/10.1590/S0034-737X2012000400007

Bowden A.T., Knight P.R., Ryals J.B., Coker C.E., Langlois S.A., Broderick S.R., Blythe E.K., Sakhanokho H.F., Babiker E.M. 2022. Evaluation of one-time applications of foliar applied auxin co-applied with surfactant for use in commercial cutting propagation. Agronomy 12(10): 2243. https://doi.org/10.3390/agronomy12102243

Braha S., Rama P. 2018. Impact of the shoot maturity level on rooting, acclimatisation of green and semi-hardwood cuttings of the blueberry (*Vaccinium corymbosum* L.) cv. bluecrop stimulated with indol butyric acid and naphthalene acetic acid. Agriculture & Forestry/Poljoprivreda i šumarstv 64(3): 79-87. https://doi.org/10.17707/AgricultForest.64.3.07

Chatse D.B., Kedar D.P. 2021. Propagation of *Hibiscus* through cutting and grafting- a review. International Journal of Current Microbiology and Applied Science 10(03): 1850-1853. https://doi.org/10.20546/ijcmas.2021.1003.232

Chowdhuri T.K., Sadhukhan R., Mondal T., Das S. 2017. Effect of different growth regulators on propagation of China rosa (*Hibiscus rosa-scinensis*) in subtropical zone of West Bengal. International Journal of Development Research 7(9): 15122-15125. https://www.journalijdr.com/sites/default/files/issue-pdf/10073.pdf

Damodaran S., Strader L.C. 2024. Factors governing cellular reprogramming competence in Arabidopsis adventitious root formation. Developmental Cell 59(20): 2745-2758. https://doi.org/10.1016/j.devcel.2024.06.019

Devika M., Divya J., Roshni R. 2022. A study on the rooting responses of stem cuttings of *Hibiscus rosa-sinensis* L. Bishop Moore College, Mavelikara. http://localhost:9494/xmlui/handle/123456789/51

Ercişli S., Eşitken A., Anapali O., Şahin U. 2004. Effects of substrate and IBA-concentration on adventitious root formation on hardwood cuttings of *Rosa dumalis*. ISHS Acta Horticulturae 690: I International Rose Hip Conference (pp. 149-152). https://doi.org/10.17660/ActaHortic.2005.690.22

Izadi Z., Zarei H. 2014. Evaluation of propagation of Chinese Hibiscus (*Hibiscus rosa-scinensis*) through stenting method in response to different IBA concentration and rootstocks. American Journal of Plant Sciences 5(13): 1836-1841. https://doi.org/10.4236/ajps.2014.513197

Karabulut N.S., Saraçoğlu O. 2022. The effects of cinnamic acid and IBA treatments on the rooting of wood cuttings of black mulberry (*Morus nigra* L.). Turkish Journal of Food and Agriculture Sciences 4(1): 1-5. https://doi.org/10.53663/turjfas.927191

Kaushik R., Kashyap M., Kumar S., Rani K., Richa. 2025. Effect of NAA and IBA on rooting parameters of stem cutting of Hibiscus (*Hibiscus rosa-sinensis* L.). International Journal of Advanced Biochemistry Research 9(9S): 1355-1357. https://doi.org/10.33545/26174693.2025.v9.i9Sq.5703

Lima C.C., Ohashi S.T., Simões P.H., Oliveira Jucoski G., Silva P.A., da Silva J.P., da Silva C.R., Nogueira G.A., Nascimento V.R., de Araújo Brito A.E., Palheta L.F. 2019. Effect of indol-3-butiric acid (IBA) on rooting of cuttings of *Schizolobium parahyba* var. *amazonicum* (Huber ex Ducke) Barneby. Australian Journal of Crop Science 13(5): 761-766. https://doi.org/10.21475/ajcs.19.13.05.p154

Liu P., Zhang S., Wang X., Du Y., He Q., Zhang Y., Shen L., Hu H., Zhang G., Li X. 2025. Adventitious root formation in cuttings: Insights from Arabidopsis and prospects for woody plants. Biomolecules 15(8): 1089. https://doi.org/10.3390/biom15081089

Magyar-Tábori K., Mendler-Drienyovszki N., Hanász A., Zsombik L., Dobránszki J. 2021. Phytotoxicity and other adverse effects on the in vitro shoot cultures caused by virus elimination treatments: Reasons and solutions. Plants 10(4): 670. https://doi.org/10.3390/plants10040670

Mitra D., Saha M., Chatterje S. 2024. A mini review on phytochemical and therapeutic potentiality of *Hibiscus*: an ornamental plant species. Journal of Medicinal Plants Studies 12(2): 63-67. https://doi.org/10.22271/plants.2024.v12.i2a.1655

Otiende M.A., Nyabundi J.O., Ngamau K., Opala P. 2017. Effects of cutting position of rose rootstock cultivars on rooting and its relationship with mineral nutrient content and endogenous carbohydrates. Scientia Horticulturae 225: 204-212. https://doi.org/10.1016/j.scienta.2017.07.009

Rahdari P., Mohana M., Asadi. 2011. The effect of zinc sulfate on IBA- and NAA-induced rooting of semi-hardwood cuttings of Aralia and its environmental impacts. Journal of Natural Resources Science and Technology 5(1): 95-103. (In Farsi). https://www.magiran.com/p1848879

Roth O., Yechezkel S., Serero O., Eliyahu A., Vints I., Tzeela P., Carignano A., Janacek D.P., Peters V., Kessel A., Dwivedi V.

2024. Slow release of a synthetic auxin induces formation of adventitious roots in recalcitrant woody plants. Nature Biotechnology 42(11): 1705-1716. https://doi.org/10.1038/s41587-023-02065-3

Shadparvar V., Mohammadi Torkashvand A., Alinejad Alamshiri H. 2011. Effect of IBA and soil mixture on rooting of (*Hibiscus rosa-sinensis*). European Journal of Experimental Biology 1(4): 142-146. https://www.primescholars.com/articles/effect-of-iba-and-soil-mixture-on-rooting-of-ihibiscus-rosa-sinensisi-90961.html

Singh K.K. 2014. The effect of various concentration of NAA and IBA on the rooting of soft wood cutting of *Hibiscus rosa scinensis* under mist house condition in Uttarakhand. Indian Strems Research Journal 4(9): 1-5.

Tawfik A.A., Ibrahim O.H., Abdul-Hafeez E.Y., Ismail S.A. 2018. Effect of cutting type, indol-3-butyric acid and the growing season on rooting of stem cuttings of *Rosa hybrida* cv Eiffel Tower. Journal of Plant Production 9(6): 537-542. https://doi.org/10.21608/jpp.2018.36346

Zarrinbal M., Moalemi N.A., Daneshvar M.H. 2005. Effects of different concentrations of auxins, time of cutting and environmental conditions on rooting of the semi-hardwood cuttings of *Callistemon viminalis* Sol. Iranian Journal of Horticultural Science and Technology 6(3): 121-134. (In Farsi).

HOW TO CITE THIS ARTICLE

Bidarnamani F. 2026. Cutting Type and IBA Hormone on Rooting Traits of *Hibiscus rosa sinensis*. *Agrotechniques in Industrial Crops* 6(3): 298-304. 10.22126/ATIC.2026.12056.1213