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Evaluation of Fig Cutting Rooting to Various Media and Iba Levels

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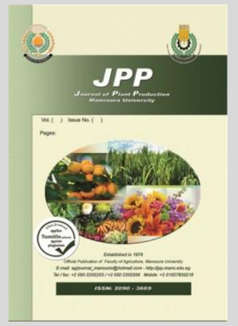

ABSTRACT

The present investigation was carried out to determine the optimal concentration of Indole-3-butyric acid (IBA) for fig (Brown Turkey *cv.*) cuttings under two planting media (Peatmoss, and clay soil). The hardwood cuttings were collected from one-year-age branches during January 2023. Fig cuttings were treated with different concentrations of IBA (0, 500 mg/l, 1000 mg/l, 1500 mg/l, and 2000 mg/l). The results of the current investigation indicated that the treatment of IBA 2000 mg/l induced the maximum value of cutting success (93.6%, and 83.5%), root length (18.37 cm, and 14.75 cm) number of roots (33.13, and 27.73), branches length (24.3 cm, and 20.01 cm), leaves number (22.47, and 19.33), fresh weight of leaves (22.23 g, and 19.67g) and dry weight of leaves (4.8 g, and 4.52g), in peatmoss and clay soil as growing media, respectively. Results concluded that Fig cuttings pre-treated with 2000 mg/l IBA for five seconds, and using peatmoss as growing media gave the best values and seedling characters vegetative propagation of fig cuttings.

Keywords: Fig, cuttings, IBA, Peatmoss

INTRODUCTION

Fig (*Ficus carica* L., *Moraceae* family) is one of the most important deciduous trees worldwide, not only as a food source but also for its medicinal properties to treat various illnesses such as leprosy, nose bleeding, antipyretic, emollient, laxative, liver disease, and others (Ishnaiwer, 2023 Additionally, it is consumed as a fresh or dried form and serves as a critical resource of trace elements, especially, iron, calcium, and potassium. Also, it is an excellent source of vitamins like thiamin (vitamin B1) and riboflavin (vitamin B2) (Kösoğlu *et al.*, 2022). These trees were demonstrating proficiency in enduring winter dormancy and pruning interventions. This distinct adaptability culminates in making Fig trees optimally conducive for integration within the field of agroforestry (Kumar, *et al.*, 2023).

The issue of successful plant propagation has garnered considerable attention in recent times. Notably, semi-hardwood cutting serves as the predominant method due to its heightened efficacy and minimal costs. This technique is favored by nursery professionals because it simplifies execution while simultaneously facilitating medium-to-large-scale plant production. Furthermore, this approach assures continual availability of cultivars with optimal rooting capacity, effectively reinforcing its widespread preference among practitioners (Santos-Rufo, *et al.*, 2024).

Propagation via cuttings constitutes a method of an asexual plant reproduction, facilitating prolific plant production applicable in horticulture, forestry, agriculture and diverse commercial fields (Stevens *et al.*, 2018). Regrettably, the restricted capacity to elicit adventitious root (AR) initiation and development in most ligneous plants presents a considerable impediment to the successful utilization of asexual reproductive methods. The primary factor influencing the success of cuttings is the formation of adventitious root development. Which environmental factors as well as internal and external biological substances have an impact on them, where the phenolic substances accumulation, enzyme content, and auxin concentration in cuttings determine their capacity to produce robust seedlings (Amrajaa, *et al.*, 2023).

The application of auxin is instrumental in the successful propagation and cultivation of cuttings from fruit trees (El Malahi, *et al.*, 2024). Extensive literature has affirmatively demonstrated the efficacy of auxins in stimulating root growth of cuttings across a variety of plant species (Yusnita, *et al.*, 2024). The significance of exogenous auxin in AR formation has been well-recognized previously (Quan *et al.*, 2017). Among auxin compounds, ones such as the 3-indolebutyric acid (IBA), are particularly known to stimulate AR initiation in plant cuttings, a finding corroborated by Li *et al.*'s study in 2016. As an extended side-chain variant of auxin, IBA not only exhibits greater stability than its counterpart IAA but also has proven efficacy in promoting the initiation of AR from cuttings sourced from species that otherwise pose difficulties in establishing roots (Griffin and Lasseigne's, 2005). The most significant growth regulators are phytohormones, which are hormones that influence, promote, and aid in the growth, and development of cells and tissues. Because of its excellent capacity to stimulate root initiation and low toxicity, IBA, is one of the most important auxins utilized as a growth regulator and is most frequently employed to promote the root growth process in cuttings (Abuazizah, *et al.*, 2023; Amrajaa, *et al.*, 2023).

Consequently, understanding the fundamental processes that govern AR formation within these woody species is imperative, which will be instrumental in surmounting existing obstacles impeding advancements in our utilization of asexual propagation methods. The current investigations aim to find the most important IBA

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concentration and growing media for improving root initiation and development of fig cuttings.

MATERIALS AND METHODS

Experimental Site, Design and Layout

The present study was carried out on a private farm in Al Bayda Governorate at Al Gabal Al Akhadar, Libya. The study aimed to determine the optimal concentration of IBA and potting substrate. The study included two factors: Five concentrations of IBA (0, 500, 1000, 1500, and 2000 mg/l), and two potting substrates (peatmoss and clay soil as the control). Therefore, there were 10 treatments in 4 replicates in a completely randomized design.

Semi-hardwood cuttings (20-25 cm in length) of one-year-old fig branches were collected during January 2023. The cuttings were pre-treated by dipping their basal ends (up to 5 cm) in various IBA levels for 5 seconds before planting. All cuttings were then placed in polybags with the different potting substrates. The polybags were placed on separate benches in a shade net-house and then recorded the rooting percentage (%), root length (cm), number of roots, branch length (cm), number of leaves, and dry and wet weight of leaves after 210 days of planting the cuttings.

Studied Characters and Measurements

Root Formation Evaluation

The quality of the root system of cuttings growing until the end of the season (210 days) was evaluated by measuring the rooting percentage (%), root length (cm), and number of roots per cutting.

1. Rooting percentage (%): was calculated following the subsequent equation

$$\textbf{Rooting percentage} = \left[\frac{\textbf{Number of rooted cuttings}}{\textbf{Total planting cuttings}}\ \boldsymbol{x100}\right]$$

2. Average root number per cutting for 15 cuttings.
3. Average root length (cm) for 15 cuttings.
4. Average branch length (cm).
5. Average leaf number: was calculated as follows equation:

$$\left[\frac{\textbf{Sum. leaves number of cuttings}}{\textbf{Number of total cuttings}}\right]$$

6. Leaves fresh and dry weights (g): 210 days later of planting all leaves of each cutting were weighted to get the fresh weight, after that leaves were dried at 70ºC till constant weight to reach the dry weight.

Statistical Analysis

Data were statistically analyzed following the analysis of variance (ANOVA) using SPSS software, and treatment means were compared by least significant difference ($P \leq 0.05$).

RESULTS AND DISCUSSION

Effect of growing media

Table 1 illustrates the impact of growing media on fig-cutting characteristics. The results showed the peatmoss media surpassing the results obtained from clay soil for all cuttings parameters, including, rooting percentage (85.6 %), root and branch length, (13.4 cm, and 17.02 cm, respectively), as well as the average of number of roots and leaves per cutting (30.23%, and 17.20% respectively), compare with clay soil. Also, the maximum average fresh and dry weight of leaves (g/cutting), was recorded with planting fig cutting in peatmoss media which reached 17.24 g, and 3.96 g with an increase of 13.05%, and 9.09% respectively, compared with clay soil.

Table 1. The impact of growing media on the rooting and growth characteristics of fig cuttings

Growing media	Rooting percentage (%)	Root Length (cm)	No. of roots per cutting	Branch length (cm)	No. of leaves per cutting	Leaves fresh weight (g/cutting)	Leaves dry weight (g/cutting)
Clay	76.8	10.6	19.32	14.03	13.72	15.25	3.63
Peatmoss	85.6	13.4	25.16	17.02	16.08	17.24	3.96
$LSD_{0.05}$	2.046	0.137	0.621	0.322	0.672	0.304	0.073

Data presented in Table 2 shows the effect of different levels of IBA on the rooting of fig cuttings as well as the seedling's characteristics. The results showed the positive effect of using IBA on the cutting rooting and seedling characteristics, with significant differences among IBA levels. The rooting percentage success rate of the cuttings dipped in 2000 mg/l IBA was superior, recording 88.6%, an increase of almost 16% above the control. Additionally, compared to the control, 2000 mg/l IBA enhanced root and branch length by 92% and 106%, respectively. Furthermore, when fig cuttings were treated with IBA at a concentration of 2000 ppm, the greatest number of leaves/cutting and the maximum number of roots/cutting were also recorded (21.2 and 30.8, respectively). As a result, the average of fresh and dry weight of leaves/cutting increased by 64% and 43.7%, respectively.

Table 2. Effect of IBA levels on the rooting and growth characteristics of fig cuttings

IBA level	Rooting percentage (%)	Root Length (cm)	No. of roots per cutting	Branch length (cm)	No. of leaves per cutting	Leaves freshweight (g/cutting)	Leaves dry weight (g/cutting)
control	76.30	8.62	15.70	10.84	10.40	12.75	3.23
500 mg/l	77.20	9.34	16.80	11.87	11.60	13.41	3.34
1000 mg/l	79.70	11.58	21.60	14.47	13.70	15.48	3.60
1500 mg/l	84.20	13.82	26.30	18.09	17.60	18.65	4.18
2000 mg/l	88.60	16.56	30.80	22.36	21.20	20.94	4.64
$LSD_{0.05}$	3.235	0.217	0.982	0.509	1.062	0.48	0.109

Table 3 shows the effect of the interaction between growing media and IBA concentration on fig-cutting rooting capacity and growth characteristics. The greatest rooting percentage was observed once peatmoss was utilized as a rooting media and dipping fig cuttings pre-planting in 2000 mg/l IBA, which recorded 93.6% with an increase of 16.42%, and 29.64% compared with control in peatmoss and clay soil growing substrates respectively. Similarly, these treatments also gave the greatest values of roots and branch length, reaching 15.18 cm, and 19.54 cm with the same treatments (peatmoss media, and 2000 mg/l of IBA) respectively. Additionally, the same treatment significantly increased the average number of roots and leaves per cutting by 117.21%, and 104.35% compared with the control, respectively. In terms of the fresh and dry weight of the leaves (g/cutting), the cuttings were grown in peatmoss and pre-planting dipped in 2000 mg/l IBA was excelled compared to the other treatments, as the maximum average of fresh and dry weight of leaves 22.23 g/cutting, and 4.79 g/cutting, respectively.

Table 3. Influence of interaction of growing media and IBA levels on the rooting and growth characteristics of fig cuttings

Growing media	IBA level	Rooting percentage (%)	Root Length (cm)	No. of roots per cutting	Branch length (cm)	No. of leaves per cutting	Leaves fresh weight (g/cutting)	Leaves dry weight (g/cutting)
Clay	control	72.2	7.28	13.6	9.04	9.2	11.73	3.028
	500 mg/l	72.8	8.24	14.2	10.42	10.8	12.46	3.204
	1000 mg/l	76.2	10.30	18.2	13.64	12.8	14.80	3.498
	1500 mg/l	79.2	12.50	23.0	16.64	16.4	17.63	3.950
	2000 mg/l	83.6	14.70	27.6	20.40	19.4	19.65	4.486
Peatmoss	control	80.4	9.96	17.8	12.64	11.6	13.76	3.430
	500 mg/l	81.6	10.40	19.4	13.32	12.4	14.37	3.540
	1000 mg/l	83.2	12.86	25.0	15.30	14.6	16.16	3.690
	1500 mg/l	89.2	15.18	29.6	19.54	18.8	19.68	4.410
	2000 mg/l	93.6	18.40	34.0	24.32	23	22.23	4.790
$LSD_{0.05}$		2.782	0.687	1.354	0.875	1.456	0.632	0.218

These results are consistent with earlier that indicate fig plant cutting pre-dipping in IBA utilization enhances the formation of the root system and increases rooting percentage. In this respect, Soliman (2024) reported that IBA usage enhanced the formation of roots and increased rooting percentage in Almond, and Peach wood cuttings. Also, Kaviani et al., (2023) confirmed that plant hormones such as IBA and NAA) had the greatest effect on most of the pear cuttings' growth measurements (rooting percentage, root number, root length, leaf number, as well as fresh and dry weights. Also, Seif El-Yazal et al., (2022) reported that plant hormones at different concentrations had a positive effect on the rooting percentage of fig stem cuttings and consequently produced better seedling growth. The promotive effect of auxins in this regard may result from the enhancement of hydrolysis activity associated with increases in the formation of highly soluble carbohydrates and leads to the increment in root formation and better rooting, which leads to good shoot growth and good internal elements. This is due to an increase in hormones and carbohydrates in root cells, increased nutrient uptake, increased translocation of metabolites to the growing apices, enhanced callus formation, and differentiation of vascular tissues, it also promotes the differentiation of cambial initials into root primordia, and increases the mobilization of reserve food material to sites of root initiation (Soliman 2024). The same results were recorded by Abuazizah et al., (2023) and Brighenti et al., (2023) on grapes rooting woody cuttings. According to Shagufi and Gurpinder (2018), the appearance of the longest plum shoots on IBA-treated cuttings may be ascribed to the well-developed root system in such cuttings, which enhances nutrient uptake, photoassimilate production, and supplies the essential energy for cell division and elongation. Cuttings treated with IBA achieved their maximum fresh and dry weight, which might be attributed to an increase in leaf area, cell division, leaf chlorophyll content, starch, sugars, and C/N ratio.

CONCLUSION

The study outcomes revealed that there was a significant effect of IBA, and growing media on fig cuttings. Generally, the best cuttings rooting percentage and cuttings growth characteristics were obtained when the combination of peatmoss growing media, and IBA application of 2000 mg/l.

REFERENCES

Abuazizah, M. H., Abuseif, M. I., and Amrajaa, B. N. (2023). Influence of IBA Concentrations on the Success and Growth Characteristics of Grape Rooting Cuttings (*Vitis vinifera* L.). Journal of Plant Production, 14(10), 497-500.

BN, A., Abuazizah, M. H., and Abuseif, M. I. (2023). Assessment of Grape Cuttings Rooting Behavior (*Vitis Vinifera* L.) under Various Media and IBA Concentrations. Journal of the Advances in Agricultural Researches, 28(4), 950-959.

Brighenti, A. F., de Freitas, F. R., Malohlava, I. T. C., Votre, T. C. G., Voltolini, J. A., da Silva, A. L., ... & Würz, D. A. (2023). Biostimulants and indolebutyric acid improve rooting of wood cuttings from different grapevine rootstocks. Ciência e Técnica Vitivinícola, 38(1), 1-9.

El Malahi, S., Sbah, N., Zim, J., Ennami, M., Zakri, B., Mokhtari, W., and Hassani, L. M. I. (2024). Enhancing rooting efficiency and nutrient uptake in Rosa damascena Mill. cuttings: insights into auxin and cutting type optimization. *Plant Science Today*, *11*(1), 119-131.

Griffin, J. J., and Lasseigne, F. T. (2005). Effects of K-IBA on the Rooting of Stem Cuttings of 15 Taxa of Snowbells (*Styrax spp.*). Journal of environmental horticulture, 23(4), 171-174.

Ishnaiwer, A. K. (2023). Antioxidant, phytochemical, nutritional composition, and biological activity of selected fig genotypes (Ficus carica L.).

Kaviani , B, M. Jamali, M.R, Safari, M.R. Eslami, A.R (2023) The Effect of Different Levels of Indole-3-butyric Acid (IBA) and Naphthaleneacetic Acid (NAA) on the Rooting of Pear Stem Cutting. *Journal of Horticultural Science*, **36** (4), 747-761.

Kösoğlu, İ., Konak, R., Yamaner, Ç., and Tan, N. (2022). Determination of phytochemicals of Turkish fig genetic resources. Acta Scientiarum Polonorum Hortorum Cultus, 21(6), 67-78.

Kumar, N., RAM, A., Sharma, P., Dhakad, A., Lavania, P., Upadhyaya, S., and Arunachalam, A. (2023). Effect of different IBA concentrations and potting substrates on growth of Ficus carica L. cuttings under nursery conditions. Indian Journal of Agroforestry, 25(1).

Li, S. W., Shi, R. F., Leng, Y., and Zhou, Y. (2016). Transcriptomic analysis reveals the gene expression profile that specifically responds to IBA during adventitious rooting in mung bean seedlings. BMC genomics, 17, 1-23.

Ludwig-Müller, J. (2000). Indole-3-butyric acid in plant growth and development. Plant Growth Regulation, 32, 219-230.

Quan, J., Meng, S., Guo, E., Zhang, S., Zhao, Z., and Yang, X. (2017). De novo sequencing and comparative transcriptome analysis of adventitious root development induced by exogenous indole-3-butyric acid in cuttings of tetraploid black locust. BMC genomics, 18, 1-14.

Santos-Rufo, A., Rodríguez-Solana, R., Fernández-Recamales, M. Á., Sayago-Gómez, A., and Weiland-Ardaiz, C. M. (2024). Comparative analysis of anatomical characteristics and phenolic compounds of two highbush blueberry (*Vaccinium corymbosum* L.) cultivars with different rooting ability of semi-hardwood cuttings. Scientia Horticulturae, 324, 112591.

Seif El-Yazal, M.A, Morsi, M.E. and El-Shewy, A.A. (2022) A Combination of Wounding, IBA and NAA Resulted in Better Rooting and Shoot Sprouting in White Adriatic Fig (*Ficus Carica* L.) Stem cuttings. *Journal of Agricultural Research*. **7** (1), 1-9.

Shagufi, N. and Gurpinder, K. (2018) Influence of Growth Regulators on the Regeneration and Survival of Plum cv. Kala Amritsari through Stem Cuttings. *International Journal of Agriculture Innovations and Research.* **7** (3), 320-324.

Soliman, G. M. (2024). Studies on Propagation of New Almond× Peach Hybrids by Hard Wood Cuttings. Egyptian Journal of Horticulture, 51(1), 87-101.

Stevens, M. E., Woeste, K. E., and Pijut, P. M. (2018). Localized gene expression changes during adventitious root formation in black walnut (*Juglans nigra* L.). Tree physiology, 38(6), 877-894.

Yusnita, Y., Hapsoro, D., Prayogi, A. N., Agustiansyah, A., and Karyanto, A. (2024). Successful Grafting of Two Indonesian Clones of *Piper nigrum* L. with P. colubrinum Link.: Effects of IBA and NAA on Rooting and Effects of BA on Grafting. AGRIVITA Journal of Agricultural Science, 46(1), 28-37.

تقييم استجابة تجذير عقل التين تحت بيئات زراعية مختلفة ومستويات من أندول البيوتريك IBA

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الملخص

تم إجراء البحث لتحديد التركيز الأمثل من حمض الإندول-3- بيوتريك (IBA) لعقل التين (.Brown Turkey cv)، تحت وسطين للزراعة (البيتموس، والتربة الطينية). تم جمع قصاصات عقل الخشب الصلب من فروع عمرها سنة واحدة خلال شهر يناير 2023. وتمت معالجة قصاصات التين بتركيزات مختلفة من أندول بيوتريك (0، 500 مجم/لتر، 1000 مجم/لتر، 1500 مجم/لتر، و 2000 مجم/لتر). أشارت نتائج البحث إلى أن معاملة IBA 2000مجم/لتر أدت إلى أعلى قيمة لنجاح القطع (93.6%، 83.5%)، طول الجذر (18.37 سم، 14.75 سم)، عدد الجذور (33.13، 27.73)، طول الفروع. (24.3 سم، 20.01 سم)، عدد الأوراق (22.47، 19.33)، وزن الأوراق الطازجة (22.23 جم، 19.67 جم) والوزن الجاف للأوراق (4.8 جم، 4.52 جم)، في وسطي النمو (البيتموس والتربة الطينية) على التوالي. وتم تسجيل ذلك تحت نفس المعاملة بعد 210 أيام من الزراعة. خلصت النتائج إلى أن معاملة عقل التين قبل الزراعة بـ IBA 2000مجم/لتر لمدة خمس ثواني، واستخدام البيتموس كوسط نمو أعطى أفضل القيم وخصائص النمو الخضري لعقل التين.

الكلمات المفتاحية: التين، البيتموس، IBA، هرمون التجذير، التعقيل