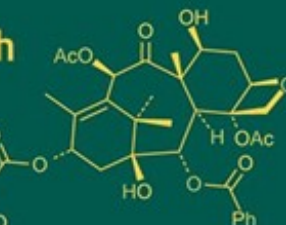
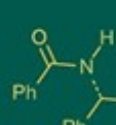


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Propagation studies in fig (*Ficus carica* L.) as influenced by planting time and IBA concentration

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ABSTRACT

The present investigation entitled "Propagation studies in fig (*Ficus carica* L.)" was conducted during 2025–26 at the Instructional-cum-Horticulture Farm, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, to standardize the suitable planting time and IBA concentration for successful propagation of fig through hardwood cuttings. The experiment was laid out in a Factorial Completely Randomized Design comprising five planting times, viz., first fortnight of April (T_1), second fortnight of April (T_2), first fortnight of May (T_3), second fortnight of May (T_4) and first fortnight of June (T_5), and four IBA concentrations, viz., 0 ppm (C_1), 1500 ppm (C_2), 2000 ppm (C_3) and 2500 ppm (C_4), resulting in 20 treatment combinations. Hardwood cuttings of 15–20 cm length having 4–5 nodes were treated with IBA through a 15-second basal quick-dip method and planted in polybags containing soil, vermicompost and neem cake in a 2:1:1 ratio. The results revealed that the planting time, IBA concentration and their interaction significantly influenced rooting characteristics and survival of fig cuttings. The second fortnight of April recorded the highest mean root length (42.42 cm) and fresh root weight (2.89 g). Among IBA treatments, 2000 ppm recorded the maximum mean root length (40.33 cm), fresh root weight (4.13 g) and superior rooting performance. The interaction between planting time and IBA concentration was most effective with the second fortnight of April combined with 2000 ppm IBA (T_2C_3), which recorded the maximum root length (49.84 cm), fresh root weight (4.50 g), number of roots per cutting (22.00), root-to-shoot ratio (0.39) and survival percentage at 90 days after planting (89.00%). The findings indicate that planting hardwood cuttings during the second fortnight of April with IBA @ 2000 ppm is suitable for producing vigorous, well-rooted and high-survival fig planting material

Keywords: IBA, Planting time, Rooting, Survival, Vegetative propagation etc.

Introduction

Fig (*Ficus carica* L.) is an economically important fruit crop belonging to the family Moraceae and is valued for its fresh and dried fruits. Production of healthy and uniform planting material is an important prerequisite for successful establishment of fig orchards. Vegetative propagation through hardwood cuttings is particularly useful because it permits multiplication of plants while retaining the desirable characteristics of the mother plant.

However, rooting of hardwood cuttings may be slow and irregular, and poor rooting can adversely affect nursery establishment and survival. Application of exogenous auxins, particularly indole-3-butyric acid (IBA), is therefore widely used to enhance adventitious root initiation and development. Studies on fig have demonstrated significant improvement in rooting, survival and subsequent vegetative growth following IBA application. Kumar *et al.*, (2023) [1] reported improved sprouting, rooting and growth of *Ficus carica* cuttings with IBA application, with 2000 ppm IBA performing particularly well under their nursery conditions. The response of fig cuttings to auxin is influenced not only by concentration but also by the physiological condition of the cutting and environmental conditions prevailing during propagation. Planting time therefore becomes an important factor in determining rooting success. Kumari *et al.*, (2020) [2] reported significant variation in rooting and survival of Brown Turkey fig hardwood cuttings planted at different times and treated with different IBA concentrations.

Similarly, recent studies have confirmed the importance of IBA in improving rooting and survival of fig cuttings. Nale *et al.*, (2024) [3] reported superior rooting and vegetative growth with IBA treatments, while Kumar *et al.* demonstrated improved rooting and survival following exogenous application of IBA and NAA.

Therefore, the present investigation was undertaken to determine the influence of planting time and IBA concentration and, particularly, their interaction on rooting, shoot development and survival of fig hardwood cuttings under Rahuri conditions.

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2. Materials and Methods

The experiment was conducted during 2025–26 at the Instructional-cum-Horticulture Farm, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, with the objective of standardizing the suitable time for rooting of fig (*Ficus carica* L.) cuttings and the appropriate IBA concentration for successful propagation. The experiment was laid out in a Factorial Completely Randomized Design (FCRD) comprising five planting times and four IBA concentrations, resulting in 20 treatment combinations. The planting-time treatments consisted of T₁: first fortnight of April, T₂: second fortnight of April, T₃: first fortnight of May, T₄: second fortnight of May and T₅: first fortnight of June, while the IBA treatments comprised C₁: 0 ppm, C₂: 1500 ppm, C₃: 2000 ppm and C₄: 2500 ppm. Hardwood cuttings measuring 15–20 cm in length and having 4–5 nodes were selected for propagation. The basal portion of the cuttings was treated with the respective IBA concentrations by the 15-second basal quick-dip method and subsequently planted in polybags containing a growing medium consisting of soil, vermicompost and neem cake in a 2:1:1 ratio. Observations were recorded on average root length at 90 days after planting (DAP), fresh weight of roots at 90 DAP, number of roots per cutting, root-to-shoot ratio and survival percentage at 90 DAP.

3. Results and Discussion

3.1 Average root length

Planting time significantly affected the average root length of fig cuttings (Table 1). The maximum mean root length of 42.42 cm was recorded in cuttings planted during the 2nd fortnight of April (T₂), followed by the 1st fortnight of April (T₁) with 37.49 cm and the 1st fortnight of June (T₅) with 33.76 cm. The minimum root length of 27.31 cm was recorded in the 2nd fortnight of May (T₄). The superior rooting during the 2nd fortnight of April may be associated with relatively favorable temperature and humidity conditions that supported callus formation, root initiation and subsequent root elongation. The cuttings during this period may also have benefited from adequate stored carbohydrate reserves and active physiological processes in the mother shoots before exposure to severe summer conditions.

IBA concentration also significantly influenced root length. The maximum mean root length (40.33 cm) was recorded with IBA @ 2000 ppm (C₃), followed by 2500 ppm (C₄) with 37.27 cm and 1500 ppm (C₂) with 33.81 cm. The untreated control (C₁) recorded the minimum root length of 25.66 cm. The enhanced root elongation under IBA treatment may be attributed to the role of auxin in stimulating cambial activity, cell division and elongation associated with adventitious root development. Similar responses to IBA application have been reported in fig and other fruit crops, including lemon and pomegranate.

A significant interaction between planting time and IBA concentration was observed. The combination T₂C₃ (2nd fortnight of April + IBA @ 2000 ppm) produced the maximum root length of 49.84 cm, followed by T₁C₃ (44.87 cm) and T₂C₄ (44.12 cm). The minimum value (21.40 cm) was recorded in T₄C₁. The superior performance of T₂C₃ suggests that an appropriate IBA concentration combined with favorable planting conditions provided a conducive environment for rapid root initiation and elongation.

3.2 Fresh weight of roots

Planting time significantly influenced fresh root weight at 90 DAP (Table 2). The maximum mean fresh root weight (2.89 g) was obtained from cuttings planted during the 2nd fortnight of April (T₂), whereas the minimum (2.52 g) was recorded in the 1st fortnight of May (T₃), which was statistically at par with the 2nd fortnight of May (T₄). Favorable temperature and relative humidity during the 2nd fortnight of April may have promoted early root establishment and sustained metabolic activity, resulting in greater root biomass accumulation.

Among IBA treatments, IBA @ 2000 ppm (C₃) produced the significantly highest mean fresh root weight (4.13 g), followed by 2500 ppm (3.67 g) and 1500 ppm (1.62 g). The untreated control recorded only 1.23 g. The increase in root biomass under IBA application may be associated with enhanced adventitious root formation and mobilization of stored reserves towards the basal portion of the cuttings. The present findings are consistent with earlier observations reported for fig and pomegranate cuttings.

The interaction effect was significant, with T₂C₃ recording the highest fresh root weight (4.50 g). This was followed by T₁C₃ (4.16 g), T₅C₃ (4.03 g) and T₄C₃ (4.02 g). The lowest value (1.08 g) occurred under T₃C₁. Thus, the combination of the 2nd fortnight of April and IBA @ 2000 ppm resulted in greater root biomass than the other treatment combinations.

3.3 Number of roots per cutting

Root formation was strongly influenced by both planting time and IBA concentration (Table 3). The maximum number of roots (22.00 roots per cutting) was recorded under T₂C₃, i.e., second fortnight of April combined with 2000 ppm IBA. This was followed by T₂C₄ (21.80 roots), T₅C₃ (20.48 roots) and T₃C₃ (20.20 roots). The minimum number of roots (10.80 roots per cutting) was recorded under T₄C₁, i.e., second fortnight of May without IBA. Thus, the maximum interaction treatment produced approximately twice the number of roots observed under the poorest treatment combination.

The improvement in rooting under IBA treatment may be attributed to the role of auxin in stimulating cell division and differentiation at the basal region of cuttings, thereby promoting adventitious root initiation. Reddy *et al.*, (2019) [4] also reported that auxin application substantially improved the percentage of rooting, number of roots of fig hardwood cuttings, demonstrating the importance of auxin in developing a vigorous root system. Similar responses have been reported in guava, where IBA-treated cuttings exhibited superior rooting and survival compared with untreated cuttings (Bhusari *et al.*, 2023) [5].

4. Root-to-shoot ratio

Root-to-shoot ratio differed significantly among the treatment combinations and data represented in Table 4. The highest root-to-shoot ratio (0.39) was recorded under T₂C₃, i.e., second fortnight of April + 2000 ppm IBA. The next highest values were observed under T₂C₄ and T₅C₄ (0.38 each). The lowest ratio (0.12) was recorded under T₅C₁, i.e., first fortnight of June without IBA.

The higher root-to-shoot ratio under T₂C₃ indicates that the treatment promoted comparatively greater root development and favourable balance between underground and above-ground growth. Varssini *et al.*, (2025) [6] also demonstrated that the interaction between rooting media and auxin treatments significantly influenced root initiation and subsequent morphological growth of fig stem cuttings. Kumar *et al.*, (2025) [7] further reported that combined application of IBA and NAA improved rooting attributes and survival of fig hardwood cuttings, with the most effective treatment producing 26 roots per cutting and 87.35% survival at 90 DAP.

3.5 Survival percentage at 90 DAP

Survival percentage was one of the most important indicators of successful propagation data illustrate in Table 5. The highest survival percentage (89.00%) was recorded under T₂C₃, i.e., second fortnight of April combined with 2000 ppm IBA. This was followed by T₂C₂ (84.00%), T₂C₄ (82.00%), T₁C₃ (80.12%) and T₁C₄ (72.00%). The lowest survival percentage (40.00%) was recorded under T₄C₁, i.e., second fortnight of May without IBA. Thus, the difference between the best and poorest interaction combinations was 49 percentage points. The markedly higher survival under T₂C₃ may be associated with superior root formation and a favourable root-to-shoot relationship. Similarly, Korche *et al.*, (2023) reported that fig hardwood cuttings treated with 2000 ppm IBA in combination with soil + PSB + VAM recorded superior rooting characteristics and the highest survival percentage at 90 DAP (78.44%), demonstrating the beneficial role of IBA in successful establishment of fig cuttings. Supporting ev

idence from another fruit crop was reported by Bhusari *et al.*, (2025) [8], who found that IBA application improved rooting attributes and survival of guava softwood cuttings, with IBA @ 4000 ppm and growing media recording the highest survival among the growth-regulator treatments.

3. Conclusion

The study demonstrated that planting time and IBA concentration significantly influenced the rooting and establishment of fig cuttings. Among the treatment combinations, planting during the 2nd fortnight

of April in combination with IBA @ 2000 ppm (T₂C₃) consistently produced superior results for root length, fresh root weight, number of roots, root-to-shoot ratio and survival percentage at 90 DAP. Therefore, planting fig cuttings during the 2nd fortnight of April with IBA @ 2000 ppm can be considered an effective treatment combination for promoting vigorous rooting and successful establishment of fig cuttings under the conditions of the present study

Table 1. Effect of planting time and IBA concentrations on average root length (cm) in fig cuttings

Treatment	T ₁ (1 st fortnight of April)	T ₂ (2 nd fortnight of April)	T ₃ (1 st fortnight of May)	T ₄ (2 nd fortnight of May)	T ₅ (1 st fortnight of June)	Mean
C ₁ (IBA 0 ppm)	26.32	29.56	23.52	21.40	27.52	25.66
C ₂ (IBA 1500 ppm)	38.46	46.14	26.88	26.78	30.80	33.81
C ₃ (IBA 2000 ppm)	44.87	49.84	35.84	31.92	39.20	40.33
C ₄ (IBA 2500 ppm)	40.32	44.12	35.28	29.12	37.52	37.27
Mean	37.49	42.42	30.38	27.31	33.76	34.27
	<i>T</i>		<i>C</i>		<i>T X C</i>	
S. Em. ±	0.39		0.35		0.77	
C.D. at 5%	1.07		0.96		2.14	

Table 2. Effect of planting time and IBA concentrations on fresh weight of root (g) in Fig

Treatment	T ₁ (1 st fortnight of April)	T ₂ (2 nd fortnight of April)	T ₃ (1 st fortnight of May)	T ₄ (2 nd fortnight of May)	T ₅ (1 st fortnight of June)	Mean
C ₁ (IBA 0 ppm)	1.15	1.57	1.08	1.22	1.15	1.23
C ₂ (IBA 1500 ppm)	1.62	1.70	1.70	1.37	1.74	1.62
C ₃ (IBA 2000 ppm)	4.16	4.50	3.94	4.02	4.03	4.13
C ₄ (IBA 2500 ppm)	3.74	3.81	3.34	3.57	3.87	3.67
Mean	2.67	2.89	2.52	2.54	2.70	2.66
	<i>T</i>		<i>C</i>		<i>T X C</i>	
S.Em.±	0.05		0.04		0.10	
C.D. at 5%	0.14		0.12		0.27	

Table 3. Effect of planting time and IBA concentrations on number of roots per cutting in fig

Treatment	T ₁ (1 st fortnight of April)	T ₂ (2 nd fortnight of April)	T ₃ (1 st fortnight of May)	T ₄ (2 nd fortnight of May)	T ₅ (1 st fortnight of June)	Mean
C ₁ (IBA 0 ppm)	14.00	15.30	11.90	10.80	11.78	12.76
C ₂ (IBA1500 ppm)	14.60	19.50	19.30	13.00	13.15	15.91
C ₃ (IBA 2000 ppm)	18.70	22.00	20.20	14.80	20.48	19.24
C ₄ (IBA 2500 ppm)	20.30	21.80	19.12	16.20	19.86	19.46
Mean	16.90	19.65	17.63	13.70	16.32	16.84
	<i>T</i>		<i>C</i>		<i>TXC</i>	
S.Em.±	0.23		0.21		0.46	
C.D. at 5%	0.64		0.57		1.27	

Table 4. Effect of planting time and IBA concentrations on root to shoot ratio in fig cuttings

Treatment	T ₁ (1 st fortnight of April)	T ₂ (2 nd fortnight of April)	T ₃ (1 st fortnight of May)	T ₄ (2 nd fortnight of May)	T ₅ (1 st fortnight of June)	Mean
C ₁ (IBA 0 ppm)	0.13	0.21	0.13	0.14	0.12	0.15
C ₂ (IBA 1500 ppm)	0.18	0.19	0.19	0.16	0.19	0.18

(continued on next page)

Treatment	T ₁ (1 st fortnight of April)	T ₂ (2 nd fortnight of April)	T ₃ (1 st fortnight of May)	T ₄ (2 nd fortnight of May)	T ₅ (1 st fortnight of June)	Mean
C ₃ (IBA 2000 ppm)	0.37	0.39	0.30	0.31	0.36	0.34
C ₄ (IBA 2500 ppm)	0.38	0.38	0.27	0.29	0.38	0.34
Mean	0.26	0.29	0.22	0.23	0.26	0.25
	<i>T</i>		<i>C</i>		CXT	
S.E.m.±	0.01		0.01		0.01	
C.D. at 5%	0.02		0.02		0.04	

Table 5. Effect of planting time and IBA concentrations on survival percentage at 90 DAP in fig cuttings

Treatment	T ₁ (1 st fortnight of April)	T ₂ (2 nd fortnight of April)	T ₃ (1 st fortnight of May)	T ₄ (2 nd fortnight of May)	T ₅ (1 st fortnight of June)	Mean
C ₁ (IBA 0 ppm)	47.00	51.00	42.00	40.00	42.00	44.40
C ₂ (IBA 1500 ppm)	71.00	84.00	48.00	46.00	55.00	60.80
C ₃ (IBA 2000 ppm)	80.12	89.00	64.00	57.00	70.00	72.02
C ₄ (IBA 2500 ppm)	72.00	82.00	63.00	52.00	67.00	67.20
Mean	67.53	76.50	54.25	48.75	58.50	61.11
	<i>T</i>		<i>C</i>		<i>T X C</i>	
S.E.m.±	1.35		1.21		2.70	
C.D. at 5%	3.74		3.35		7.49	

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