

# Evaluation the Rooting Behavior of Caprifig Cultivars Cuttings in Fars Province

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**Abstract** – In order to evaluate rooting behavior of Caprifig cultivars cuttings including ‘Dane-Sefid’, ‘Vil’, ‘Pouz-Donbali’ and ‘Khormaei’ by using 6 treatments was conducted an experiment as factorial arrangement in randomized complete block design with 4 replications. For this purpose, the cuttings were prepared from annual shoots in February 2011 and the cuttings were treated by ambient water, distilled water, salt water (EC=2000 mmos/cm) and different concentrations of IBA consisting 500, 1000 and 1500 mgL<sup>-1</sup> for 20 seconds. The treated cuttings were cultured in the plastic pots containing perlite and sand mixture and were kept in the greenhouse for one year. In the end on the experiment, the rooted cuttings percent, the grown cuttings number, root volume and root dry weight were measured. Based on the results, the cultivars had significant difference in relation to rooting percent. The evaluated cultivars based on treatment type showed different and significant behavior. The grown cuttings percent, root dry weight and root volume in the cultivars and depending to treatment type had significant difference. Generally, the best results obtained from IBA 1000 mgL<sup>-1</sup> treatment.

**Keywords** – IBA, Caprifig, Rooting.

## I. INTRODUCTION

Fig (*Ficus carica* L.) belongs to Moraceae family and Eusyce sub genus. Ficus genus has been formed about 700 species that often are growing in tropical regions [2]. Iran is one of the main regions of genetic diversity of wild and edible figs in the world, which has 42000 ha fig land under cultivation and more than 95% of fig gardens are located in Fars province [14]. In Iran, the most important provinces in fog growing are Fars, Markazi, Semnan, Kermanshah, Isfahan and Yazd respectively. In the difficult-rooting rootstocks removal problem of vegetative propagation is necessary. Propagation by hard-wood cuttings is the most cheap and easiest method of vegetative propagation, which is used in many fruit trees and ornamental plants [7]-[11]. Different treatments are using to increase success propagation by cutting, which external application of plant growth regulators is one of the most common methods [12]-[17]. Principle role of auxin in rooting induction and formation of root promoters has been confirmed. Auxin affects on rate and enhancement of rooting percent in the cuttings. Plants produce natural auxin in the young shoots and leaves but for successful rooting must be used artificial auxin to prevent cuttings dead [8]-[16]. Siddiqui and Hussain [15] evaluated the effect of different concentrations of IBA on rooting of Hawaii fig cuttings and reported that the highest growth percent, leaf number, plant height, leaf area, shoot diameter, root length and root number was observed in

IBA 4000 mgL<sup>-1</sup> treatment and the lowest in control treatment. In the other study, Kucuk *et al.* [9] observed the highest root number, growth rate, root length and shoot length in Banana fig cultivar by using IBA 4000 mgL<sup>-1</sup> while the lowest rooting rate, root number, root length and shoot length observed in Nazareth fig cultivar. Regards to compatibility of fig to Fars province climate, there are various methods for garden construction such as cutting, sucker and the rooted plant [6], which because of acceleration for reach to bearing age, production of the rooted plants has more importance. Therefore, determination the best hormonal treatment to increase rooting of Caprifig cuttings has high importance. Although there are a few investigation on influence of hormones on rooting of edible fig cultivars cuttings in Iran but there is no comprehensive report in relation to effect of hormone on rooting of some Caprifig cuttings in Iran. Therefore, the present study was performed in order to evaluate the effect of IBA on rooting of Caprifig cuttings including ‘Dane-Sefid’, ‘Vil’, ‘Pouz-Donbali’ and ‘Khormaei’.

## II. MATERIALS AND METHODS

In order to evaluate rooting behavior of Caprifig cuttings was performed a study as factorial arrangement in randomized complete block design in Neiriz city. For this purpose, the cuttings were prepared from annual shoots of Caprifig cultivars including ‘Dane-Sefid’, ‘Vil’, ‘Pouz-Donbali’ and ‘Khormaei’ in February 2011 and the cuttings were treated by ambient water, distilled water, salt water (EC=2000 mmos/cm) and different concentrations of IBA consisting 500, 1000 and 1500 mgL<sup>-1</sup> for 20 seconds. Then the cuttings were cultured in plastic pots containing perlite and sand mixture and the pots were kept in the greenhouse with 10-40 °C and 50-60% RH for one year. Finally, the rooted cuttings percent, the grown cuttings number, root volume and root dry weight were measured. The obtained data was analyzed by using MSTAT-C software and the means were compared by Duncan’s multiple range test (DMRT).

## III. RESULTS

### *The rooted cutting percent*

Based on the results of variance analysis, cultivar type, treatment type and their interaction had significant influence ( $p < 0.01$ ) on rooting percent (Table1). According to the results of mean comparison, all cultivars had significant difference ( $p < 0.05$ ) in relation to the rooted cuttings percent and their arrangement was ‘Dane-

Sefid' > 'Vil' > 'Pouz-Donbali' > 'Khormaei' (Table 2). IBA 500 and 1000 mgL<sup>-1</sup> significantly showed the highest rooting percent and the greatest rooting percent (100%) was relative to 'Dane-Sefid' cultivar and using salt water and IBA 500 mgL<sup>-1</sup>. 'Vil' cultivar showed equal rooting percent (75%) in the all treatments (Table 2). In 'Dane-Sefid' cultivar, the highest rooting percent was observed in application salt water and IBA 500 mgL<sup>-1</sup>; in 'Pouz-

Donbali' cultivar in application of IBA 1000 mgL<sup>-1</sup> and in 'Khormaei' cultivar in application IBA 500 and 1000 mgL<sup>-1</sup>. In 'Vil' cultivar, application or non-application of different treatments had no influence on rooting percent. 'Dane-Sefid' cultivar shows positive reaction in application ambient, distilled and salt water and IBA 1500 mgL<sup>-1</sup> than other cultivars in viewpoint of rooting percent.

Table 1: Analysis of variance (MS) in relation to the evaluated traits

S.V	D.F	Mean Square			
		Grown cutting No.	Rooting percent	Root volume	Root dry weight
Cultivar (A)	3	74.2**	13032.4**	1533.6**	9.8 <sup>ns</sup>
Treatment (B)	5	10.0**	1875.0**	335.6 <sup>ns</sup>	33.2**
Interaction AB	15	4.2**	470.7**	913.4**	24.8**
Error	72	0.7	2.3	261.2	4.7
C.V %		14.8	2.6	2.4	22.0

<sup>ns</sup>, \*\*, \*\* not significant, Significant in 5 and 1% level respectively.

### The grown cutting number

Based on the results of variance analysis, cultivar type, treatment type and their interaction had significant influence ( $p < 0.01$ ) on number of the grown cuttings (Table 1). According to the results of mean comparison, 'Dane-Sefid' cultivar had highest number of the grown cutting and the lowest was relative to 'Pouz-Donbali' cultivar. The greatest number of the grown cutting was observed in

IBA 1000 mgL<sup>-1</sup> and the lowest in salt water treatment (Table 3). In 'Dane-Sefid' and 'Vil' cultivars, application of different treatments had no influence on the grown cutting number. In 'Pouz-Donbali' cultivar application IBA 1000 mgL<sup>-1</sup> and in 'Khormaei' cultivar application IBA 500 and 1000 mgL<sup>-1</sup> had positive effects in the grown cutting number than other treatments.

Table 2: Effect of cultivar, treatment and their interaction in relation to rooting percent

Cultivar \ Treatment	Dane-Sefid	Vil	Pouz-Donbali	Khormaei	Treatment Mean
Ambient water	†75.0 <sup>b</sup>	75.0 <sup>b</sup>	50.0 <sup>c</sup>	25.0 <sup>d</sup>	††56.2 <sup>C</sup>
Distilled water	75.0 <sup>b</sup>	75.0 <sup>b</sup>	50.0 <sup>c</sup>	25.0 <sup>d</sup>	56.2 <sup>C</sup>
Salt water	100.0 <sup>a</sup>	75.0 <sup>b</sup>	25.0 <sup>d</sup>	25.0 <sup>d</sup>	56.2 <sup>C</sup>
IBA 500	100.0 <sup>a</sup>	75.0 <sup>b</sup>	50.0 <sup>c</sup>	75.0 <sup>b</sup>	75.0 <sup>A</sup>
IBA 1000	75.0 <sup>b</sup>	75.0 <sup>b</sup>	75.0 <sup>b</sup>	75.0 <sup>b</sup>	75.0 <sup>A</sup>
IBA 1500	75.0 <sup>b</sup>	75.0 <sup>b</sup>	50.0 <sup>c</sup>	50.0 <sup>c</sup>	62.5 <sup>B</sup>
Cultivar Mean	††86.1 <sup>A</sup>	75.0 <sup>B</sup>	50.0 <sup>C</sup>	47.2 <sup>D</sup>	

The means having same letter, have not significant difference according to DMRT ( $p < 0.05$ ).

††Uppercase and †lowercase letters are relative to main effect of factors and their interaction respectively.

Table 3: Effect of cultivar, treatment and their interaction in relation to the grown cutting number

Cultivar \ Treatment	Dane-Sefid	Vil	Pouz-Donbali	Khormaei	Treatment Mean
Ambient water	†6.0 <sup>bc</sup>	6.0 <sup>bc</sup>	4.0 <sup>de</sup>	2.0 <sup>f</sup>	††4.5 <sup>D</sup>
Distilled water	7.0 <sup>ab</sup>	7.0 <sup>ab</sup>	4.0 <sup>de</sup>	3.0 <sup>ef</sup>	5.2 <sup>C</sup>
Salt water	8.0 <sup>a</sup>	6.0 <sup>bc</sup>	3.0 <sup>ef</sup>	3.0 <sup>ef</sup>	5.0 <sup>CD</sup>
IBA 500	7.0 <sup>ab</sup>	7.0 <sup>ab</sup>	4.0 <sup>de</sup>	6.0 <sup>bc</sup>	6.0 <sup>B</sup>
IBA 1000	8.0 <sup>a</sup>	7.0 <sup>ab</sup>	6.0 <sup>bc</sup>	6.0 <sup>bc</sup>	6.8 <sup>A</sup>
IBA 1500	8.0 <sup>a</sup>	7.0 <sup>ab</sup>	2.0 <sup>f</sup>	5.0 <sup>cd</sup>	5.5 <sup>BC</sup>
Cultivar Mean	††7.3 <sup>A</sup>	6.7 <sup>B</sup>	3.8 <sup>C</sup>	4.2 <sup>C</sup>	

The means having same letter, have not significant difference according to DMRT ( $p < 0.05$ ).

††Uppercase and †lowercase letters are relative to main effect of factors and their interaction respectively.

### Root volume

Based on the results of variance analysis, cultivar type and interaction between cultivar and treatment had significant influence ( $p < 0.01$ ) on root volume but

treatment type had no significant influence on root volume (Table 1). The highest root volume was observed in 'Dane-Sefid' cultivar, which this cultivar had no significant difference to 'Khormaei' cultivar ( $P < 0.05$ ). The

lowest root volume was observed in ‘Pouz-Donbali’ cultivar. In relation to effect of treatments on root volume, only significant difference was between ambient water and salt water and other treatments had no significant difference together (Table 4). The greatest root volume was observed in ambient water in ‘Dane-Sefid’ cultivar and the lowest in distilled water in ‘Pouz-Donbali’ cultivar (Table 4). In ‘Dane-Sefid’ cultivar, the greatest root volume was observed in application ambient water; in ‘Vil’ cultivar, in application distilled water; in ‘Pouz-

Donbali’ cultivar in application IBA 1500 mgL<sup>-1</sup> and in ‘Khormaei’ cultivar in application IBA 1000 mgL<sup>-1</sup>. ‘Dane-Sefid’ cultivar shows positive reaction in application ambient and salt water and IBA 500 mgL<sup>-1</sup> than other cultivars in viewpoint of root volume. In this relation ‘Vil’ cultivar had significant reaction to distilled water, ‘Pouz-Donbali’ to IBA 1500 mgL<sup>-1</sup> and ‘Khormaei’ cultivar to IBA 1000 mgL<sup>-1</sup> than other cultivars in viewpoint of root volume.

Table 4: Effect of cultivar, treatment and their interaction in relation to root volume

Cultivar \ Treatment	Dane-Sefid	Vil	Pouz-Donbali	Khormaei	Treatment Mean
Ambient water	†67.7 <sup>a</sup>	38.3 <sup>bcde</sup>	25.0 <sup>def</sup>	20.0 <sup>def</sup>	††37.8A
Distilled water	24.3 <sup>def</sup>	45.0 <sup>abcd</sup>	7.5 <sup>f</sup>	40.0 <sup>bcde</sup>	29.2AB
Salt water	29.6 <sup>cdef</sup>	21.7 <sup>def</sup>	30.0 <sup>cdef</sup>	15.0 <sup>ef</sup>	24.1B
IBA 500	53.0 <sup>abc</sup>	21.7 <sup>def</sup>	22.5 <sup>def</sup>	25.0 <sup>def</sup>	30.5AB
IBA 1000	38.3 <sup>bcde</sup>	26.7 <sup>cdef</sup>	8.3 <sup>f</sup>	58.3 <sup>ab</sup>	32.9AB
IBA 1500	36.0 <sup>bcde</sup>	21.7 <sup>def</sup>	40.0 <sup>bcde</sup>	35.0 <sup>bcdef</sup>	33.2 <sup>AB</sup>
Cultivar Mean	††41.5 <sup>A</sup>	29.2 <sup>BC</sup>	22.2 <sup>C</sup>	32.2 <sup>AB</sup>	

The means having same letter, have not significant difference according to DMRT ( $p < 0.05$ ).

††Uppercase and †lowercase letters are relative to main effect of factors and their interaction respectively.

#### Root dry weight

Results of variance analysis indicated that treatment type and interaction between cultivar and treatment had significant influence ( $p < 0.01$ ) on root dry weight but cultivar type had no significant influence on root dry weight (Table 1). The highest root dry weight was observed in ‘Vil’ cultivar, which this cultivar had no significant difference to ‘Khormaei’ and ‘Dane-Sefid’ cultivars ( $P < 0.05$ ). Control and IBA 1000 and 1500 mgL<sup>-1</sup> treatments allocated the highest root dry weight and interaction between two factors indicated that the highest

root dry weight was relative to ‘Khormaei’ cultivar and IBA 1000 mgL<sup>-1</sup> (Table 5). In ‘Dane-Sefid’ and ‘Vil’ cultivars, the highest root dry weight was observed in application ambient water; in ‘Pouz-Donbali’ cultivar in application IBA 1500 mgL<sup>-1</sup> and in ‘Khormaei’ cultivar in application IBA 1000 mgL<sup>-1</sup>. ‘Dane-Sefid’ cultivar shows positive reaction in application IBA 500 mgL<sup>-1</sup> than other cultivars in viewpoint of root dry weight. In this relation ‘Vil’ cultivar had significant reaction to ambient, distilled and salt water than other cultivars in viewpoint of root dry weight.

Table 5: Effect of cultivar, treatment and their interaction in relation to root dry weight

Cultivar \ Treatment	Dane-Sefid	Vil	Pouz-Donbali	Khormaei	Treatment Mean
Ambient water	†7.16 <sup>bcd</sup>	7.82 <sup>bc</sup>	5.72 <sup>cdefg</sup>	3.39 <sup>efgh</sup>	††6.02 <sup>A</sup>
Distilled water	4.03 <sup>defgh</sup>	5.03 <sup>cdefgh</sup>	2.13 <sup>gh</sup>	4.57 <sup>cdefgh</sup>	3.94 <sup>B</sup>
Salt water	3.02 <sup>fgh</sup>	5.76 <sup>cdefg</sup>	5.57 <sup>cdefg</sup>	3.29 <sup>efgh</sup>	4.41 <sup>B</sup>
IBA 500	6.00 <sup>cdef</sup>	5.15 <sup>cdefgh</sup>	4.54 <sup>cdefgh</sup>	2.19 <sup>gh</sup>	4.47 <sup>B</sup>
IBA 1000	5.27 <sup>cdefgh</sup>	4.92 <sup>bc</sup>	1.71 <sup>h</sup>	12.52 <sup>a</sup>	6.86 <sup>A</sup>
IBA 1500	6.78 <sup>bcde</sup>	6.80 <sup>bcde</sup>	9.73 <sup>ab</sup>	6.23 <sup>bcdef</sup>	7.38 <sup>A</sup>
Cultivar Mean	††5.4 <sup>AB</sup>	6.4 <sup>A</sup>	4.9 <sup>B</sup>	5.4 <sup>AB</sup>	

The means having same letter, have not significant difference according to DMRT ( $p < 0.05$ ).

††Uppercase and †lowercase letters are relative to main effect of factors and their interaction respectively.

## IV. DISCUSSION

Application of auxin showed significant influence on rooting percent of Caprifig cuttings so that the highest rooting percent obtained from IBA 500 and 1000 mgL<sup>-1</sup> and in IBA 1500 mgL<sup>-1</sup> decreased. Reason of rooting enhancement in the treated cuttings by auxin is more analysis of nutrient resources by auxin [10]. Reason of rooting reduction in higher concentration of IBA is reverse

effect of auxin in higher concentrations. In this relation, reaction of cultivars was various so that ‘Dane-Sefid’ cultivar had the highest and ‘Khormaei’ cultivar the lowest rooting percent. This subject shows that ‘Dane-Sefid’ and ‘Vil’ cultivars are easy-rooting while ‘Khormaei’ and ‘Pouz-Donbali’ are difficult-rooting. The obtained results in the present study are according to the findings of Antunes *et al.* [1] and Chalfoun *et al.* [4]. They reported that rooting of fig cuttings in ‘Roxo Valinhos’ and ‘Ficus

*carica*' respectively by using IBA 1000 mgL<sup>-1</sup> was better than control treatment. Also the present results are according to the findings of Boozari *et al.* [3] on apple and Exdaktylo *et al.* [5] on Sweet cherry. On the other hand, Seddighi and Hossein [15] reported that IBA 4000 mgL<sup>-1</sup> had the best effect on rooting of 'Hawaii' fig. Rajeswara-Reddy *et al.* [13] the highest rooting percent, root number, root length and survival of the rooted cuttings obtained in IBA 2500 + NAA 2500 mgL<sup>-1</sup> or IBA 2500 mgL<sup>-1</sup> in both hard and semi-hard wood cuttings of *Ficus carica*. These results demonstrate that the applied auxin concentration is various depending to the cultivar and cutting type.

## V. CONCLUSION

According to the above results was found that 'Dane-Sefid' and 'Vil' cultivars are easy-rooting and 'Pouz-Donbali' and 'Khormaei' cultivars are difficult-rooting. In this experiment the most suitable IBA concentration for enhancement of rooting was 1000 mgL<sup>-1</sup>.

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