THE INFLUENCE OF SOME PHYTOHORMONES ON THE ROOTING OF FIG CUTTINGS

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Abstract

The fig is a subtropical fruit species. In the Republic of Macedonia it is grown mainly, in the form of individual plants. Lately there is interest for establishing orchards from this fruit species. The purpose of this research was to determine the influence of some phytohormones on the rooting of hardwood cuttings from fig. The research was conducted with cuttings from 3 domestic populations of figs, "Bela smokva,, "Crna smokva,, and "Petrovka,,. The research was performed on an experimental field, property of the "Faculty of Agricultural Sciences and Food,, in Skopje. In the research, two phytohormones were used, indolebuteryc acid 0,1% and 1-Naphthaleneacetic acid 0,1%. In the end of the vegetation period the following parameters were evaluated: percentage of rooting, diameter and length of the shoots, the total mass of the roots, the length and nubmer of roots with a diameter above 3mm. On the basis of our research we determined that all of the cuttings had a satisfactory, high, percentage of rooting (86,2%). In the population of "Petrovka,, the treatments did not show any statistical significant differences on the evaluated characteristics, regarding the control treatment. With the cuttings from "Bela smokva,, treated with NAA, statistical significant difference was found in the parameter mass of the roots (12,2g), while regarding the nubmer and length of roots, this treatment, had statistical significant difference just with the control but not with the IBA treatment. With "Crna smokva,, the cuttings treated with IBA had the highest values with statistical significant difference with the number (4,5), the mass (24,3 g) and the length of the roots (179,3 cm).

Keywords: *Ficus carica*, IBA, NAA, propagation.

Introduction

The fig tree (*Ficus carica* L.) has gained more interest in recent years for its economic importance and medicinal virtues. It is considered to be a rustic plant, a fruit species of great economic importance and in expansion worldwide, with good adaptation to different climates and soil types (Rodrigues *et al*. 2012). In the Republic of Maceodnia the fig is grown on a limited scale, in the form of individual fruit plants and rarely in a commercial orchard. Lately there is interest for establishing orchards from this fruit species. Improvement of farming techniques (Fraquas *et al.*2004), the sanitation of local varieties (Mars *et al*., 2008), and the large scale production of good quality and healthy fig plants seem to be basic requirements for successful commercial orchards. This requires the ability of rapid propagation of local figs. Almost all grown cultivars are the result of old selection and maintained by vegetative propagation (Mars, 2003). The fig has a great ability for vegetative propagation, which is by micropropagation, layering, aerial layering, rooting of adventitious shoots, with hardwood and softwood cuttings. The fig tree is usually propagated by hardwood cuttings that are collected from the basal and median portions of the branches at the time of winter pruning, undertaken during the period of dormancy (Karedeniz, 2003; Sousa *et al*., 2013). Some cultivars have low rooting potential. Low rooting of hardwood cuttings may be related to factors inherent to the plant material, such as age of the tissue, time of collection of cuttings, and phytohormone concentration, or exogenous factors, such as the growing conditions of the cutting (Han *et al*., 2009). The use of auxins has shown excellent results in increasing the root formation in fig tree cuttings (; Lajus *et al*., 2007; Pio *et al*., 2008; Ramos *et al*., 2008). Theoretically, nowadays there are studies regarding the regulatory role of phytohormones in the process of root formation. In practice, many

efforts are made in order to find optimal conditions for rooting the cuttings of different species, especially those, where the rooting formation is hard (Stefančič *et al*., 2007) However, variation in the rooting potential of cuttings is a characteristic inherent to the genetic potential. This study aimed to determine the rooting potential of tree promising domestic populations of figs "Bela smokva,, "Crna smokva,, and "Petrovka,, with the use of two auxin phytohormones NAA and IBA.

Material and methods

The cuttings from "Bela smokva,, and "Crna smokva,, were obtained from the region of Valandovo and those from "Petrovka,, from the Skopje region. The cuttings were collected in January. They were kept in a plastic bag in a refrigerator on a temperature of 2^{o}C until the end of February. The cuttings were prepared from the middle and basal portion of the branch. The cuttings were about 30 cm long, the bottom part of the cutting is cut flat under the node and the top slightly obliquely in the opposite direction of the bud. Then, the cuttings were treated with individual phytohormones in the following variants:

1. NAA 0,1% dipped 1 min
2. IBA 0,1% dipped 1 min
3. Control (not treated)

After the treatment the cuttings were put in a black plastic bag and were kept in a dark room for a period of 7 days. After this period the cuttings were planted in a nursery at a distance of 10 cm inside the row and 100 cm between the rows, on a light soil. For the research, 30 cuttings were used for each variant, divided by 3 repetitions for each variant. During the vegetative period, the nursery was grown using standard technology. At the end of the vegetative period the cuttings were dug out after the leaves have dropped and the following parameters were evaluated: percentage of rooting, diameter and length of the shoots, the total weight of the roots above 3 mm, the length and nubmer of roots with a diameter above 3 mm. The percentage of received cuttings was determined according the number of received cuttings and the total number of cuttings set. The diameter of shoots was measured with a caliper. The length of the shoots and roots was measured with a measuring tape. The mass of the roots was determined with a scale (KERN EMB 600-2, d=0,01 g). The differences were evaluated by ANOVA analysis through general linear model procedure. After the GLM analyses, post hoc comparison of the means were calculated by LSD. Results were expressed at the $p < 0,05$ level of significance. Statistical analyses were performed using SPSS (IBM SPSS Statistics 19).

Results and discussion

In figure 1 we can observe that the highest percentage of rooted cuttings was obtained in the second variant (88,5%) while the lowest percentage of rooting was observed in the first variant (83,9). In figure 2 we can see that all of the populations of figs investigated have a high percentage of rooting. The highest percentage of rooting can be seen in the second variant in Bela smokva with a 92,3 % of rooting and in the control variant in Crna smokva with the same percentage. The lowest percentage of rooting can be observe in the first and third variant at the population Petrovka with a percentage of rooting of 81,3. In table 1 we can observe that the highest values, regarding the studied morphometric characteristics, with statistical significant difference with the control variant, were obtained in the second variant, length of the shoots was 48,5 cm, length of the roots 103,3 cm and number of roots above 3 cm 3,0. With the exception of the mass of the roots which was highest in the first variant (16,0 g).

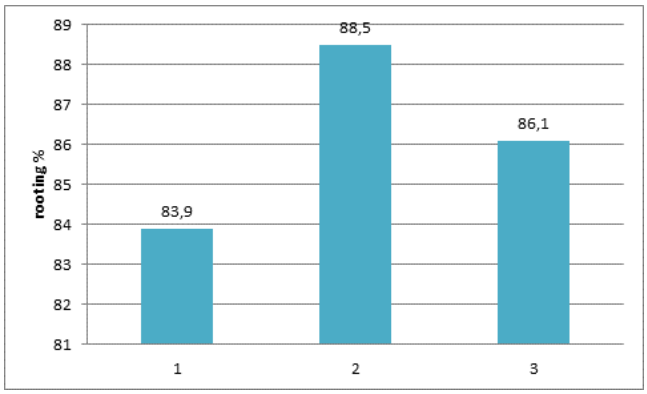

Figure 1. Percentage of rooting by variants

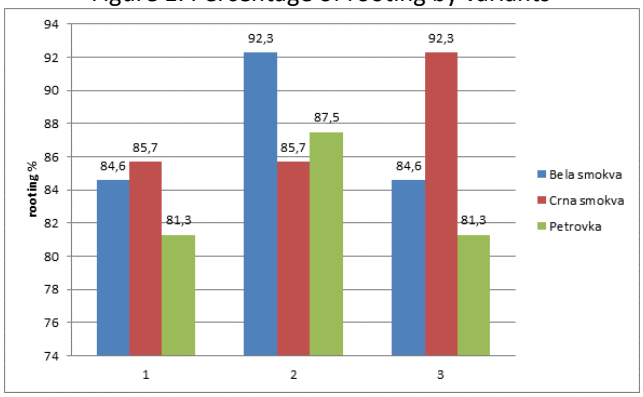

Figure 2. Percentage of rooting by fig population and variant

Table 1. Morphometrical characteristics of the rooted cuttings by variants

Variant	Diameter of the shoots (cm)	Length of the shoots (cm)	Mass of the roots (g)	Length of the roots (cm)	Number of roots (above 3cm)
1	7,0	44,8 b	16,0 a	74,9 ab	2,0 ab
2	7,1	48,5 b	15,0 a	103,3 b	3,0 b
3	6,6	38,3 a	13,3 a	33,3 a	1,3 a
$LSD_{0,05}$	5,4	4,4	31,1	1.2	

* Values followed by the same letter in the column were not statistically different.

Table 2. Morphometric characteristics of the rooted cuttings from Bela smokva

Population	Variant	Diameter of the shoots (cm)	Length of the shoots (cm)	Mass of the roots (g)	Length of the roots (cm)	Number of roots (above 3cm)
Bela smokva	1	7,5	54,1 b	16,2 b	69,7 a	1,7 b
	2	6,7	52,0 b	8,6 a	58,3 ab	2,2 b
	3	5,5	26,3 a	6,1 a	20,3 b	0,4 a
$LSD_{0,05}$		30,7	7,2	45,0	1,1	

* Values followed by the same letter in the column were not statistically different.

In table 2 we can see that in the population of Bela smokva the highest values for length of the shoots (54,1 cm), mass of the roots (16,2 cm) length of the roots (69,7 cm) with the exception of number of roots (1,7) were obtained with the use of NAA 0,1%. All of the examined morphometric characteristics were statistically significantly different from the control variant.

In the population of Bela smokva best results were obtained with the use of the second variant. The length of the shoots (67,1 cm), mass of the roots (24,3 g), length of the roots (179,3) and number of roots (4,3) (Table 3). All of the mentioned characteristics were statistically significantly different in

comparison with the control variant. In table 4 we see that in the population of Petrovka there is no statistical significant difference between the studied characteristics regarding the variants.

Table 3. Morphometric characteristics of the rooted cuttings from Crna smokva

Population	Variant	Diameter of the shoots (cm)	Length of the shoots (cm)	Mass of the roots (g)	Length of the roots (cm)	Number of roots
Crna smokva	1	6,2	48,8 b	13,4 bc	90,3 b	2,5 b
	2	8,0	67,1 a	24,3 a	179,3 a	4,3 a
	3	6,2	43,7 b	11,4 b	29,3 b	1,2 b
$LSD_{0,05}$		14,2	8,3	71,3	1,5	

* Values followed by the same letter in the column were not statistically different

Table 4. Morphometric characteristics of the rooted cuttings from Petrovka

Population	Variant	Diameter of the shoots (cm)	Length of the shoots (cm)	Mass of the roots (g)	Length of the roots (cm)	Number of roots
Petrovka	1	7,2	31,5 a	18,4 a	64,7 a	1,7 a
	2	6,6	26,5 a	12,0 a	72,3 a	2,4 a
	3	8,1	44,9 a	22,4 a	50,3 a	2.3 a
$LSD_{0,05}$		27,1	16,7	55,1	3,1	

* Values followed by the same letter in the column were not statistically different

Conclusions

On the basis of our research we can make several conclusions:

Regarding the treatments, the highest averige percentage of rooting was observed in the second variant (88,5) and the lowest percentage was achieved with the first variant (83,9). The highest values regarding the studied morphometric characteristics, with statistical significant difference with the not treated cuttings, were obtained with the use of IBA 0,1%, length of the shoots was 48,5 cm, length of the roots 103,3 cm and number of roots above 3 cm was 3,0. With the exception of the mass of the roots which was highest in the plants treated with NAA 0,1% (16,0 g). All of the studied variants of the populations of “Bela smokva,, “Crna smokva,, and “Petrovka,, had a high percentage (above 81,3) of rooting. Even though the studied populations when not treated have a natural high percentage of rooting, the use of the phytohormones showed statistical significant difference in: length of the shoots, mass of the roots, length of roots and number of roots in two of the populations. For the rooting of hardwood cuttings from the population of “Bela smokva,, the use NAA 0,1% can be recommended. In the population of “Crna smokva,, best results were obtained with the use of IBA 0,1% regarding the studied characteristics. In the populations of “Petrovka,, however, the phytohormones did not have an statistical significant difference regarding the studied parameters.

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